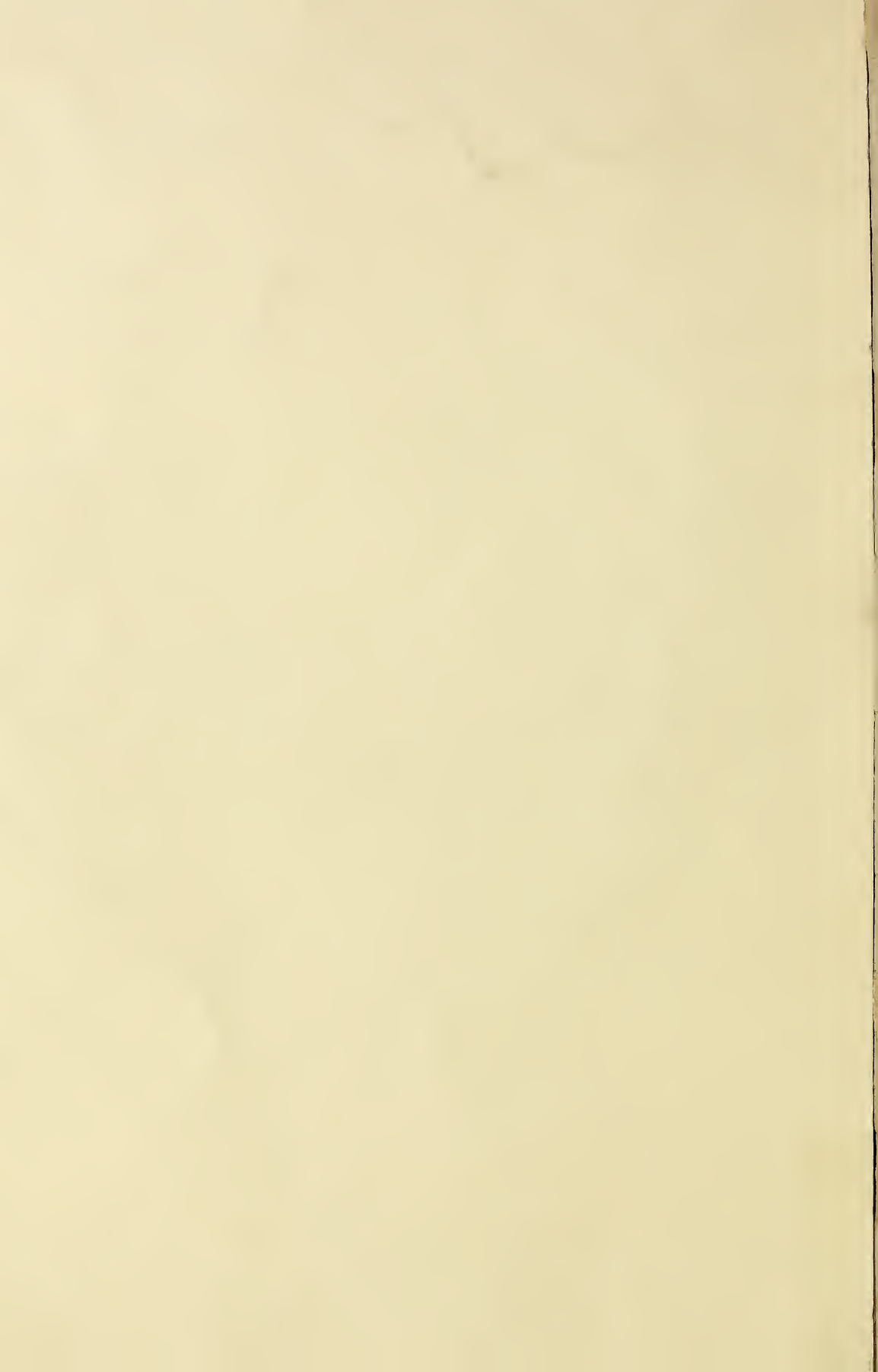


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Vol. VIII.

JULY, 1902.

No. 10.

THE AGRICULTURAL STUDENT



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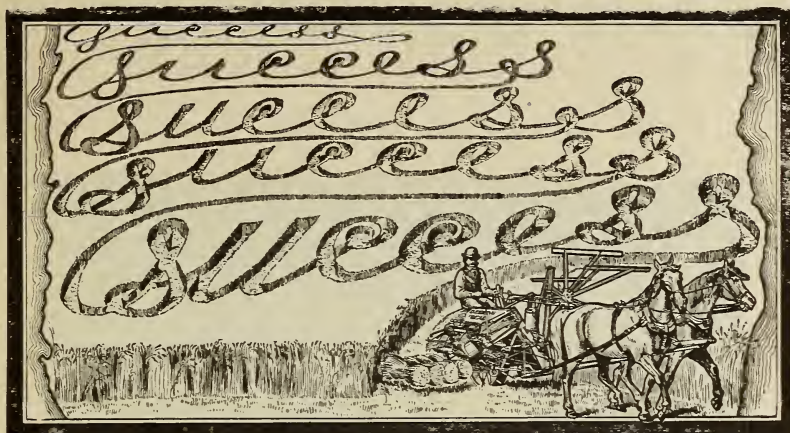
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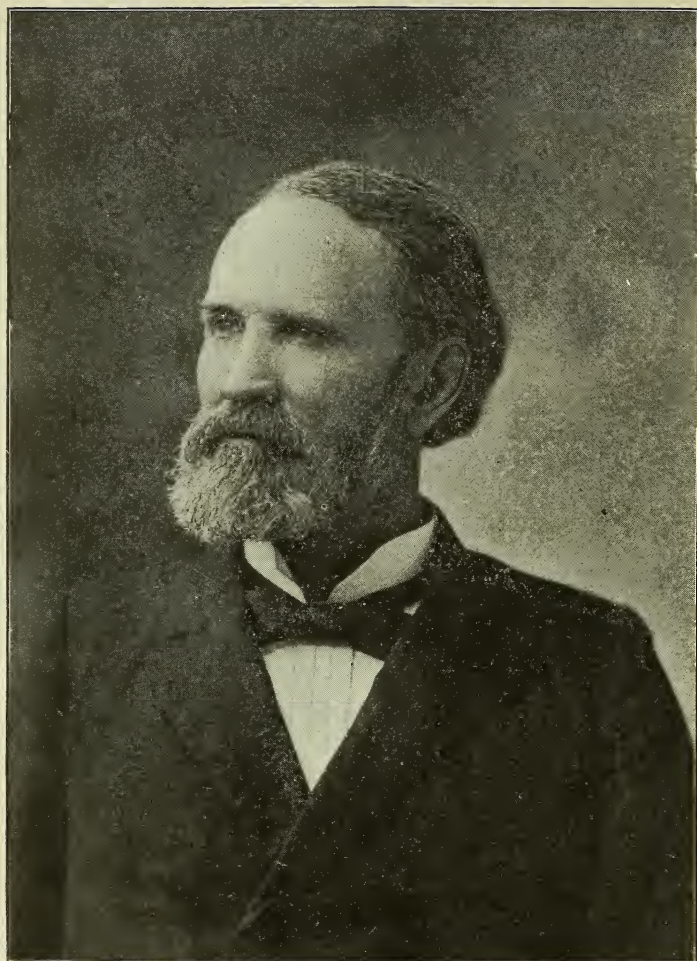
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THE AGRICULTURAL STUDENT.

VOL. VIII.

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EDITORIAL CHAT.

The editor's corner must necessarily be very much restricted this issue; first, because the editor is now busily engaged in mapping the soils of Colorado, and again the large amount of news connected with the Graduate School makes it unwise for the substitute editor to occupy space with anything he might presume to say.

This number of *THE STUDENT* has been materially enlarged and devoted entirely to the Graduate School. It has been our endeavor as far as possible to give the inaugural addresses and the Saturday conferences as fully as space would permit; also a complete list of the matriculated students, with their degrees, titles and present addresses. Items of news directly connected with the school are also given, thus making the number a souvenir of the first session of the Graduate School. *THE STUDENT* deems it an honor to be thus closely connected with this new endeavor in agricultural education, and extend our congratulations to the originators and promoters of the scheme upon the marked success of the initial effort in this direction.



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It is not necessary for us to say much of the objects and aims of the Graduate School of Agriculture. These will be found in other columns of this issue.

Seventy-five students were registered from thirty states and territories, the District of Columbus, and Canada. Many of these students are men of mature years who have had wide experiences and the school has afforded them a splendid opportunity not only to widen their field of knowledge, but to get together and compare results of past, and plans for future work. A smaller number of the students are recent graduates who expect to follow college and station work. And what an inspiration and help it has been to them to meet in a personal way the leaders in thought along agricultural educational lines. The field for future work looks wider and more inviting to the earnest and enthusiastic beginner than ever before. Again, a still smaller number of the students are practical farmers, who left their farms and came here that they might learn more of their profession. In many ways this is one of the most pleasing features of the attendance, for it shows an interest upon the part of the farmer and will remove any doubt (still in the minds of many farmers), as to the earnestness and sincerity of the efforts of scientific men in behalf of the farmer.

We cannot refrain from calling attention to the corps of instructors, composed of some thirty-six of the recognized leaders in their special lines of work the world over. Every one acquainted with what has been done in agricultural education knows their names as household words. The managers of the school are certainly to be congratulated upon the securing of such a splendid corps of instructors.

While this session was simply an experiment, if the united opinion of every member of the faculty and student body

counts for anything, the Graduate School will be a permanent thing from this time on.

We have been very much disappointed in not being able to give President White's address delivered at the inaugural exercises, and also an article on "Mendell's Law," by Prof. Webber. Both of these were promised us, but at the time of going to press neither paper has been received.

News Items.

Upon invitation by Prof. Lazenby the teachers and investigators in horticulture held an interesting conference in Horticultural Hall, Friday evening, July 18. The courses of study in the horticultural department of various colleges and universities were considered and experiment station work was discussed. Prof. W. M. Munson, of Maine, acted as chairman.

Representatives were present from Maine, Vermont, Rhode Island, New York, Ohio, Michigan, Missouri, Alabama, Georgia, Mississippi, and Utah.

The work in the courses of Zootechny and Dairying was made eminently practical and more instructive by actual demonstrations with living animals. These the breeders of the state very generously furnished. Specimens of the various breeds were received as follows:

Short horn cattle, from Arthur H. Jones, Delaware, O.

Aberdeen Angus cattle, D. Bradfute & Son, Xenia, O.

Holstein Friesian cattle, W. B. Smith & Sons, Columbus, O.

Cotswold sheep, D. B. Watt, Xenia, O.

Hampshire sheep, D. H. Cherry, Xenia, O.

Cheviott sheep, Ed. S. Foutz, Xenia, O.

Merino sheep, R. D. Williamson, Xenia, O.

French coach and draft horses, McLaughlin Bros., Columbus, O.

The college herd was also drawn upon heavily in the work in dairying and swine judging.

A large number of the students visited the Holstein Friesian herd of W. B. Smith & Sons, at the State Hospital, Saturday, July 19. Every one was well pleased with Mr. Smith's herd and pronounced it one of the best of its kind they had ever seen.

An excursion took a large number of the students to Delaware Saturday, July 26, to visit the red polled herd of Mr. Hill and the short-horn herd of Mr. Jones, of that place. Those interested in horticulture visited the orchards of Mr. F. P. Vergon, one of the most successful orchardists in central Ohio.

Monday evening, July 7, an informal reception was given at the Great Southern Hotel, from half-past four to six, in honor of Secretary Wilson, of Washington, D. C.; Colonel Liggett, of Minnesota; Dr. True, of Washington, D. C., and President White, of Georgia. Afterwards a complimentary dinner was given these gentlemen in the private dining room of the hotel, over thirty persons being present. After dinner the party immediately repaired to the inaugural exercises at the University Chapel.

The alumni of the Agricultural College of the University gave an informal reception to the instructors, students and friends of the Graduate School, Thursday evening, July 10, in Townshend Hall. About one hundred people were present and thirty states, the District of Columbia and Canada were represented.

This was the first opportunity visitors had had of meeting those who were to be their fellow students for the coming three weeks. A slip of paper was pinned on each person, with their name and state. Thus the formality of an introduction was made unnecessary, and every one was enabled to become easily and quickly acquainted.

Saturday, July 12, about thirty members of the school, accompanied by Prof. Lazenby, visited the Livingston's trial gardens, just west of the University grounds. The Livingston Co. kindly provided wagons to ferry the party across the river opposite the University, but the water was beyond the depth of the horses and the entire party was forced to walk to the bridge. Much was learned of the seedsmen's methods of originating and trying new varieties, and after a pleasant trip over the farm the party was returned to the city by the company.

On Friday, July 18, about twenty members of the Graduate School, under leadership of Prof. Whitney, Chief of Division of Soils, U. S. Department of Agr., and W. T. Carter, B. S., Assistant in Soil Survey, took a trip east of Columbus to go over some of the ground covered by the Soil Survey in this region. Prof. Whitney pointed out to the class the Miami gravelly loam, Miami clay loam and the Miami black clay loam and discussed their special adaptation to various crops.

Owing to the lack of time and unfavorable weather, the trip was shortened somewhat, the intention being to go over also the Miami loam and Miami sandy loam.

Thursday evening, July 17, Prof. and Mrs. Hunt gave a delightful informal reception, from 8 to 10, to all persons connected with the summer school and their

friends, at their beautiful home on Tenth avenue.

About one hundred people called during the evening, including practically the entire instructional and student body connected with the summer school, together with many University people who were still in the city. Punch and ices were served on the spacious lawn and the evening passed pleasantly and all too quickly. The party broke up with best wishes for a continuous prosperous career for Professor Hunt and his amiable wife.

Friday evening, July 25, the young men of the Graduate School gave an informal reception and dance in Townshend Hall. A large number of the faculty and students were present, and the affair was in every way a pleasant and fitting close to the social events attending the summer school. In spite of the warm weather quite a number indulged in dancing until the lights went out. The various persons of the party then wended their different ways homeward more glad than ever that they had attended the Summer School in Agriculture.

National Convention of Alpha Zeta Fraternity.

The first national convention of Alpha Zeta Fraternity was held July 15, 1902, in Lynden Hall.

Delegates from four chapters were present as follows:

From Ohio State University, H. G. Beale and C. C. Hatfield; from University of Illinois, Coates P. Bull and S. J. Haight, Jr.; from Cornell University, W. I. Thomson, and C. K. McClelland; Pennsylvania State College had no official delegates, although Prof. Hayward and Dr. Armsby were both present, as members of that chapter.

Monday evening the local chapter gave a smoker to the visiting delegates at the fraternity hall, and the evening was pleasantly and profitably passed in getting acquainted and talking over the condition of the various colleges represented. Tuesday was devoted entirely to the business of the convention, and Tuesday evening the general fraternity gave a banquet to the visiting delegates and members at the Great Southern Hotel.

After a sumptuous repast the toastmaster, Worthy Grand Counselor Cunningham, called for toasts from Dr. A. C. True, of Washington, D. C.; Prof. Smith, of Michigan; Dr. Armsby, of Pennsylvania; Prof. Zavitz, of Ontario; W. I. Thomson, of New York; and S. J. Haight, Jr., of Illinois. Each and every speaker emphasized the good work the fraternity had done for the students and the institutions in which they have been established, and the possibilities of such an organization in every agricultural college of high standing in the country.

The time for the last car came all too soon and the party dispersed with the yells of the various colleges represented. Throughout the convention there was manifest an earnestness and zeal which augurs well for the future of Alpha Zeta. The fraternity adjourned to meet at the call of the Grand Council.

The Graduate School in Agriculture.

The first session of the Graduate School of Agriculture began promptly at 8 a. m., Monday, July 7. From the beginning to the end of the session the program as previously outlined was carried out with remarkably few alterations.

The inaugural exercises, held in the University Chapel Monday evening, July 7, were well attended, but the ex-

tremely warm weather undoubtedly kept many away.



W. O. THOMPSON,
President Ohio State University.

We give the program of the Inaugural Exercises and of Courses, followed by a complete list of matriculated students. (The number in connection with each man's name refers to his picture in the frontpiece.)

INAUGURAL EXERCISES IN THE CHAPEL OF OHIO STATE UNIVERSITY, JULY 7, 1902, AT 8 P. M.

- (1) Invocation.
- (2) Address of Welcome: Wm. Oxley Thompson, D. D., LL.D., President, Ohio State University.
- (3) American System of Agricultural Education and Research: Hon. Wm. M. Liggett, Dean of the College of Agriculture of the University of Minnesota, and President of the Association of American Agricultural Colleges and Experiment Stations.
- (4) History of the Movement for Agricultural Education and Research in the United States: H. C. White, Ph. D., President of Georgia State College of Agriculture and Mechanic Arts, and Member of Executive Committee of the Association of American Agricultural Colleges and Experiment Stations.
- (5) Objects and Aims of the Graduate School of Agriculture: A. C. True, Ph. D., Director of the Office of Experiment Stations United States Department of Agricul-

ture, and Dean of the Graduate School of Agriculture.

(6) Address: Hon. James Wilson, Secretary of Agriculture.

PROGRAM OF COURSES.

AGRONOMY.

First Week—July 7-11.

Lecture Hours.

8-10 a. m.

Dr. Duggar—Principles of Plant Production and their Application to Field Crops. (Monday, Tuesday, Wednesday and Thursday.)

Prof. Spillman—Laws of Heredity in Hybrids and Their Application to Crop Production. (Friday.)

2-4 p. m.

Dr. Briggs—Application of Physical Principles and Methods to the Study of Soils.

Second Week—July 14-18.

8-10 a. m.

Prof. King—Climatology of Soils.

2-4 p. m.

Prof. Whitney—Objects and Methods of a Soil Survey. (With field exercises.)

Third Week—July 21-28.

8-10 a. m.

Prof. Voorhees—Nitrogen Potash and Phosphoric Acid as Fertilizers. (Monday, Tuesday and Wednesday.)

Prof. Wheeler—Lime and Other Soil Amendments. (Thursday and Friday.)

2-4 p. m.

Prof. Gibbs—Methods of Instruction Regarding Soils. (With laboratory exercises.)

Fourth Week—July 28 to August 1.

8-10 a. m.

Prof. Hopkins—Improvement of Corn by Breeding. (Monday, Tuesday and Wednesday.)

Prof. Duggar—Culture of Cotton. (Thursday and Friday.)

BREEDING OF PLANTS AND ANIMALS.

First Week—July 7-11.

10-12 a. m.

Dr. Webber—Principles of Plant Breeding.

Second Week—July 14-18.

10-12 a. m.

Prof. Hays—Methods of Investigation and Instruction Relating to the Breeding of Plants. (Monday, Tuesday and Wednesday.)

Prof. Munson—Methods and Results of Breeding Fruits. (Thursday and Friday.)

Third Week—July 21-28.

10-12 a. m.

Prof. Davenport—Principles of Animal Breeding.

Fourth Week—July 28 to August 1.

10-12 a. m.

Prof. Plumb—Methods of Investigation and Instruction Relating to the Breeding of Animals.

ZOOTECNHNY.

First Week—July 7-11.

8-10 a. m.

Prof. Armsby—Principles of Nutrition.

2-4 p. m.

Prof. Waters. (Monday, Tuesday and Wednesday.)

Prof. Curtiss. (Thursday and Friday.) Production and Judging of Beef Cattle. (With living animals for demonstration.)

8-10 a. m.

Second Week—July 14-18.

2-4 p. m.

Prof. Scovell—(Monday, Tuesday and Wednesday.)

Prof. Haecker—(Thursday and Friday.) Production and Judging of Dairy Cattle. (With living animals for demonstration.)

Third Week—July 21-28.

8-10 a. m.

Prof. Armsby—Principles of Nutrition. (Monday, Tuesday and Wednesday.)

Prof. Atwater—The Respiration and Bomb Calorimeters. (Thursday and Friday.) Model of Respiration Calorimeters.

2-4 p. m.

Profs. Carlyle (Sheep), Kennedy (Swine)—Production and Judging of Sheep and Swine. (With living animals for demonstration.)

Fourth Week—July 28 to August 1.

8-10 a. m.

Dr. Jordan—Feeding Experiments and Their Interpretations.

2-4 p. m.

Prof. Hunt—Animal Mechanics and Exterior of Horses. (With living animals for demonstration.)

DAIRYING.

First Week—July 7-11.

8-10 a. m.

Prof. Conn—The Bacteriology of Dairying.

2-4 p. m.

Prof. Wing—Methods of Handling Milk. (With laboratory exercises.)

Second Week—July 14-18.

8-10 a. m.

Prof. C. D. Smith—The Dairy Cow as a Milk Producer.

2-4 p. m.

Prof. Scovell—(Monday, Tuesday and Wednesday.)

Prof. Haecker—(Thursday and Friday.) Production and Judging of Dairy Cattle. (With living animals for demonstration.)

Third Week—July 21-28.

8-10 a. m.

Dr. Van Slyke—The Chemistry of Dairying and Methods of Cheese Investigation.

2-4 p. m.

Prof. McKay—Methods of Butter Making. (With laboratory demonstrations.)

Fourth Week—July 28 to August 1.

8-10 a. m.

Dr. Allen—Foreign Instruction and Research in Dairying.

2-4 p. m.

Prof. Decker—Methods of Cheese Making. (With laboratory demonstrations.)

SATURDAY CONFERENCES.

July 12.

8-10 a. m.

Prof. Bailey and Dr. Webber—Principles of Plant Breeding.

July 19.

8-10 a. m.

The Dean—What Constitutes a Science of Agriculture.

10-12 p. m.

Prof. Hunt—Organization of Agricultural Education in the United States.

July 26.

8-10 a. m.

The Dean—Educational Values of Courses in Agriculture.

10-12 p. m.

Prof. Zavitz—Methods and Values of Co-operative Experiments.

REGISTERED STUDENTS IN
GRADUATE SCHOOL.

Adams, G. E., B. S., Rhode Island A. & M. College, 1894. Assistant Agriculturist Exp. Station, Kingston, R. I.

Anderson, L., B. S., '96; M. S., '97; Ph. D., '02, Cornell University. Asst. Prof. of Dairy Husbandry and Animal Industry; Director California Polytechnic School, Berkley, Cal.

Belden, H. L., B. S., '02, Ohio State University, Middlefield, O.

Bogue, E. E., B. S., '94, M. S., '96, Ohio State University. Graduate student, Columbus, O.

Bridgeforth, G. R., B. S., '01, Mass. Agr. College. Teacher of Agriculture

and Kindred Subjects, Tuskegee Institute, Alabama.

Bull, C. P., B. S., '01, University of Minnesota, St. Anthony Park.

Burkett, C. W., B. S., '95, Ohio State University. Prof. Agriculture, Raleigh, N. C.

Card, F. W., B. S., '92, M. S., '93, Cornell. Prof. Horticulture and Acting Prof. Agriculture, Kingston, R. I.

Carter, W. T., Jr., B. S., '98, Texas A. & M. College. Asst. in Soil Survey, Bureau of Soils, Washington, D. C.

Cavanaugh, G. W., B. S., '96, Cornell. Chemist Cornell Experiment Station, Ithaca, N. Y.

Clark, H. A., B. S., '02, Ohio State University. Medina, Ohio.

Conant, W. A., Certificate Dairy School, Mass. A. & M. College, '02, Dairying, Boston, Mass.

Cook, W. M., B. A., '00, Monmouth College. Farmer, Camden, O.

Crosley, D. J., B. S., '93; M. S., '01, Michigan Agr. College. Assistant in Practical Agriculture, Dept. of Agriculture, Washington, D. C.

Crowner, D. A., B. S., '96, Ohio State University. Creamery Operator, West Jefferson, O.

Davis, V. H., B. S., '00, Ohio State University; M. S., '01, Cornell. Asst. Prof. Horticulture and Forestry, Columbus, Ohio.

Decker, J. W., B. S., '90, University of Wisconsin. Prof. of Dairying, Columbus, Ohio.

Duggar, J. F., B. S., '87, M. S., '89, Mississippi A. & M. College. Prof. Agriculture and Agriculturalist, Alabama Exp. Station, Auburn.

Dunlap, R. W., B. S., '95, Ohio State University. Farmer, Kingston, Ohio.

Echegaray, L., Student Ontario Agr. College. Argentine Republic, S. A.

Eri, Oscar, B. S., '99, Ohio State University. Instructor in Dairy Manufacturing, Champaign, Ill.

Foord, J. A., B. S., '98, New Hampshire College of A. & M. Arts; M. S., '02, Cornell. Asst. in Dairy Husbandry, Ithaca, N. Y.

Fraser, Samuel, Fellow of Highland and Agr. Society of Scotland, '98; Diploma School of Agr. and Hort., Holmes Chapel, Eng., '98; Diploma in Dairying, Royal and Highland Societies, '98. Prof. Agriculture and Agriculturalist, Briar Cliff Manor, N. Y.

French, H. T., B. S., '85; M. S., '89, Michigan Agr. College. Prof. Agriculture and Agriculturalist, Exp. Station, Moscow, Idaho.

Gill, G. W., A. B., '64; A. M., '67, Marietta College, Columbus, Ohio.

Gilmore, W. H., B. S., '99, Ohio State University. Stock Farmer, Basil, Ohio.

Goddard, L. H., C. E., '92, Ohio State University. Farmer, Manara, Ohio.

Gowell, G. M., M. S., '92, University of Michigan. Prof. Animal Industry and Agriculturalist, Exp. Station, Orono, Maine.

Griffith, W. E., Instructor in Butter Making, Ithaca, N. Y.

Dunlap, J. H., Farmer, Williamsport, Ohio.

Hall, F. H., B. S., '88, Michigan Agr. College. Editor and Librarian Agr. Exp. Station, Geneva, N. Y.

Harper, J. N., B. S., '95, Mississippi A. & M. College. Agriculturalist, Kentucky Agr. Exp. Station, Lexington.

Harper, M., B. S., '01, Ohio State University; M. S., '02, Illinois University. Student, Grove City, Ohio.

Hart, J. F., Jr., B. S., '02, University of Georgia. Fellow in Agriculture, Athens, Ga.

Hayward, H., B. S., '94; M. S., '01, Cornell. Asst. Prof. Dairy Husbandry, State College, Pa.

Hume, A. N., B. S., '00, M. S., '02, Purdue University. Asst. Agriculturalist, Exp. Station, Lafayette, Ind.

Hutchins, Mrs. M. J., Housewife, Columbus, Ohio.

Hunt, T. F., B. S., '84; M. S., '94, University of Illinois. Dean of the College of Agriculture, and Prof. of Agriculture, Columbus, Ohio.

Jennings, O. E., Florist, Columbus, Ohio.

Johnson, J. M., B. S., '94, West Virginia University, B. S., '95; M. S., '96, Cornell. Instructor Animal Husbandry Athens, Ga.

Kendall, J. C., B. S., '02, New Hampshire A. & M. College. Instructor in Dairying, West Raleigh, N. C.

Livermore, A. A., B. S., '02, New Hampshire. Student, Wilton, N. H.

Lloyd, E. R., B. S., '86; M. S., '87, Alabama A. & M. College. Prof. Agriculture and Agriculturalist, Exp. Station, Agricultural College, Miss.

Lodholz, E., M. D., '97, University of Pa. Asst. Physiologist, Philadelphia, Pa.

McClelland, C. K., B. S., '98, Ohio State University, M. S., '02, Cornell. Asst. Prof. Agriculture, West Raleigh, N. C.

McKay, A. B., B. S., '85, Mississippi Agricultural College. Prof. Horticulture and Horticulturalist, Exp. Station, Agricultural College, Miss.

McLallen, H. C., B. S., '98; M. S., '01, Cornell. Trumansburg, N. Y.

Mairs, T. I., B. S., '96; M. S., '00, Missouri University. Instructor in Animal Industry and Asst. Supt. Correspondence Courses, State College, Pa.

Merrill, L. A., B. S., '95, Utah Agr. College. Asst. Prof. Agronomy and Agronomist, Exp. Station, Logan, Utah.

Michels, J., B. S., '00, University of Wisconsin. Instructor in Dairying, Agricultural College, Mich.

Morrey, C. B., B. A., '90, Ohio State University, M. D., '96, Starling Medical College. Assoc. Prof. Physiology, Columbus, Ohio.

Moore, R. A., Instructor in Agriculture and Agriculturalist Exp. Station, Madison, Wis.

Moore, J. S., B. S., '94; M. S., '96, Mississippi A. & M. College. Prof. Dairy Husbandry, Agricultural College, Miss.

Morse, W. J., B. S., '98, University of Vermont. Instructor in Botany and Asst. Botanist, Exp. Station, Burlington, Vt.

Nesom, G. E., B. S., '95, Mississippi A. & M. College, D. V. M., '98, Iowa State College, Clemson, S. C.

Lauman, G. N., B. S., '97, Cornell. Instructor in Horticulture, Ithaca, N. Y.

Pernot, E. F., Prof. Bacteriology and State Bacteriologist, Corvallis, Oregon.

Robinson, P. E., B. S., '99, North Carolina A. & M. College. Teacher.

Roudebush, L., B. A., '71, National Normal. Farmer, Nicholasville, Ohio.

Ruhlen, F., B. S., '96, Ohio State University. Instructor in Zöotechny Columbus, Ohio.

Shaw, E. L., B. S., '02, Ohio State University. Farmer, Newark, Ohio.

Sisson, S., S. B., '98, University of Chicago, V. S. Ontario. Assoc. Prof. Veterinary Medicine, Columbus, Ohio.

Smith, J. W., B. S., '88; M. S., '00, New Hampshire A. & M. College. Section Director, United States Weather Bureau, Columbus, Ohio.

Smith, L. H., B. S., '97; M. S., '99, University of Illinois. Chief Asst. Chemist, Exp. Station, Champaign, Ill.

Stocking, W. A., Jr., B. S., '95, Connecticut Agr. College, B. S., '98, Cornell. Dairy Experimenter, Storrs, Conn.

Stone, J. L., B. S., '74, Cornell. Asst. in Agriculture, Ithaca, N. Y.

Tucker, G. M., B. S., '94, R. I. Agr. College, Ph. D., University of Göttingen. Instructor in Agriculture, Columbia, Mo.

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Objects and Aims of the Graduate School of Agriculture.

BY A. C. TRUE, DEAN.

The Graduate School of Agriculture owes its existence to an idea originating in the fertile brain of the Dean of the College of Agriculture of the Ohio State University. This idea received the cordial approval of the President of the University, and on the recommendation of these two men the board of trustees of the University took action in April, 1900, in favor of the establishment of such a school, and generously made provision for its financial support. The plan for this school was presented by the President of the University to the Association of American Agricultural Colleges and Experiment Stations at its annual convention in November, 1900, when the matter was referred to its exec-

utive committee. At the convention of 1901 this committee reported favorably on the plan and recommended that if the success of the first session seemed to justify the continuance of the school, it be made a co-operative enterprise under the



DR. A. C. TRUE.

control of the association. This action of the executive committee was endorsed by the association. The Honorable Secretary of Agriculture also expressed his cordial approval of the movement for the establishment of this school, and acting on his advice the Director of the Office of Experiment Stations consented to act as dean and other officers of the department to be members of its faculty.

As the opening of this Graduate School is a new step of progress in agricultural education in the United States, it seems fitting that the public should be informed regarding the objects and aims of this enterprise. The desirability of instituting and periodically conducting a school of this kind, in which there shall be given advanced instruction in the science of agriculture and particularly in the methods of investigating agricultural problems and teaching agricultural subjects, can perhaps be sufficiently shown by brief references to the importance and variety of our agricultural interests as

related to the present condition of our system of agricultural education and research. The agriculture of the United States, including Alaska and our island possessions, now includes the production of almost every kind of plant and animal useful to mankind, and its products are grown under all sorts of conditions of soil and climate, ranging from the Arctic Circle to the Tropics, and from the desert to regions having a very large rainfall.

For the technical education of our agricultural workers and for the improvement of our agriculture by scientific and practical investigations, we have the United States Department of Agriculture with a paid force of about 3,500 persons and an income of \$1,450,000, and 65 agricultural colleges endowed with national and state funds, in which over 4,000 students have pursued agricultural courses during the past college year. There are also a number of secondary schools of agriculture supported by public and private funds. Farmers institutes are maintained in 43 states and territories. During the past year some 2,000 institutes were held which were attended by an aggregate of over half a million farmers. Sixty-three agricultural experiment stations are maintained at an annual expense of about \$1,268,000, of which \$756,000 comes from the National Treasury. These stations employ 697 persons in the work of administration and research. They publish annually over 400 reports and bulletins which are distributed to 600,000 addresses.

This school, in which are assembled representative leaders and workers in agricultural education and research from many states and territories to consider some of the most vital problems connected with the development of agricultural education and investigation, is, in fact, an institution working in the in-

terests of all our people, but more especially of the 10,000,000 workers on our farms (where production annually aggregates over 4,000 millions of dollars in value), as well as in the interests of institutions, supported by millions of dollars of national and state funds, in which thousands of students, teachers, investigators and other workers are annually employed.

Our system of agricultural education and research, which vitally affects the progress of our vast agricultural interests, has developed very rapidly, its effective organization covering only about one-quarter of a century. Especially within the last decade there has been a remarkable development in the amount and variety of agricultural research, in the methods of agricultural education and in the financial resources of the institutions for agricultural education and research. This has led to rapid changes in the organization and work of these institutions and in the requirements of training and experience which are considered essential to the success of agricultural teachers and investigators. The demand for work on these teachers and investigators has also rapidly increased in variety and amount. Under the existing organization of our agricultural colleges and experiment stations, the workers must very often be both teachers and investigators.

Very few of our agricultural colleges are as yet able to do more than give their students an undergraduate course in agricultural subjects, and in a considerable number of those institutions, even the courses which lead to a bachelor's degree are not yet raised to the standard set by our older and stronger colleges. We are just passing out of the era when boards of trustees considered that they had done enough for agriculture as a part of the college curriculum by having on the faculty one man whom they denominated a

professor of agriculture. Considerable progress has of late been made in the division of the general subject of agriculture into branches and specialties to be taught by different members of college faculties, and a few of our stronger universities and colleges have advanced sufficiently in this direction to have established what in some real sense may be called an agricultural faculty. But it is still true that the opportunities for thorough training in agricultural science, such as is given in other sciences and in preparation for the old learned professions, are very inadequate. If this school does nothing more than to illustrate in some measure what may be done in the differentiation of agricultural subjects and the development of agricultural faculties for university instruction in agriculture, it will have served a useful purpose.

In considering the work of such a school as this it must be remembered that the regular college course in agriculture, however well planned and conducted, can do little more than give the student general instruction in the principles of agriculture. It will not ordinarily make him an expert in any one line. There is a need of higher instruction in the different branches of agricultural science in order that we may have thoroughly trained agricultural specialists and experts. We cannot hope to attain and maintain leadership in the application of science to agriculture without university instruction in agricultural science. The agricultural schools and colleges may give sufficient training to fit men to succeed well as farmers, farm managers, teachers of the general science of agriculture, and editors of agricultural journals. But the graduates of these institutions attempting to do high-grade teaching or investigating must have some further means of securing the thorough and special training they re-

quire. One aim of this graduate school is to provide a certain measure of this advanced and special instruction and thereby to illustrate some of the lines along which our universities need to establish advanced courses of instruction in agricultural specialties. The response which has been made to the call for teachers and students to organize this school is a good indication of the general and widespread feeling among the men already engaged in the work of instruction and research in agriculture in this country, that there is a real need for deeper and wider instruction in agricultural science.

The need of a larger number of men and women well trained in agricultural science, and familiar with the most approved methods of agricultural practice, is now keenly felt in various directions. Not only is the present supply of competent workers in these lines inadequate to meet the enlarged demand for professors and investigators in our agricultural colleges, experiment stations and departments of agriculture, but the spread of agricultural instruction into secondary schools of agriculture and into our public high schools is greatly hindered because teachers trained in agricultural subjects are lacking.

The comparatively few men well trained for service in agricultural institutions, farmers institutes and, generally speaking, in the cause of agricultural advancement on rational and scientific lines are badly overworked at present. We must have more workers of the right kind to swell the ranks of the vanguard of agricultural progress, and it is hoped that this school will do something to find and train recruits for this honorable service.

The cause of agricultural education and research is developing under peculiar conditions. Popular interest in this matter is already so great that demands are made upon the workers in our col-

leges and stations far beyond their ability to meet. At the same time through their own efforts and those of workers in kindred institutions at home and abroad, the materials for a true science of agriculture are accumulating faster than they are being reduced to a systematic form. While it is true that within the past few years there has been an unusual amount of activity in book writing on subjects pertaining to agricultural science and practice, yet there remain many agricultural subjects on which there are no treatises that can be considered fairly up to date. Moreover, books of reference, including dictionaries and encyclopedias, have not kept up with the advance of knowledge along agricultural lines, though within the past few years the makers of such works have made hopeful progress in this direction. In many lines of agricultural education and research the methods of instruction and investigation have not been thoroughly proved, and the apparatus and illustrative material needed in agricultural laboratories, schools, and colleges are as yet very inadequate.

This school may, therefore, serve a very useful purpose in bringing to its students summaries of up-to-date information on various agricultural subjects, and in pointing out ways in which the methods of teaching and investigating agricultural subjects may be improved and the apparatus and illustrative material for instruction and research in these subjects may be increased in variety and effectiveness.

Like other great progressive movements of our day, the cause of agricultural education and research needs systematic promotion in two directions. Well-defined plans are needed for the development of our institutions for agricultural education and research to meet the enlarged demands of our people for information and training in these lines.

We do well, therefore, to bring the workers in our agricultural institutions together to discuss the organization and development of our system of agricultural education and research. But there is also required a more thorough discussion of the methods of instruction and research in agriculture. It is true that we already have some means for carrying on general discussion in both these directions. The Department of Agriculture, especially through its Office of Experiment Stations, has acted as a center for the collection and dissemination of information regarding the organization of agricultural education and research and methods of teaching and investigation. The Association of American Agricultural Colleges and Experiment Stations has also served a most useful purpose in both these lines of endeavor. It has, however, been felt by many of the managers and workers in our agricultural institutions that neither the dissemination of publications nor the brief meetings of the Association of Colleges and Stations sufficiently met the need for a center of discussion of these general problems. For this reason the proposition for the establishment of this Graduate School of Agriculture met with much favor among the general officers of our institutions for agricultural education and research, as well as among the workers in these institutions. Though the period during which the sessions of this school can be held is necessarily brief, it nevertheless, gives a much longer time for the discussion of these problems than is afforded by the meetings of the Association of Colleges and Stations. By bringing together here for a month a considerable number of our leading agricultural teachers and investigators in these lines and a select body of the more recent graduates of our agricultural colleges who are just entering or about to enter on the work of teaching and investiga-

tion, it is believed that we have a more efficient opportunity for live discussion of up-to-date problems of agricultural education and research than has hitherto existed.

Through the generous liberality of the trustees and officers of the Ohio State University, the broadminded approval of the Honorable Secretary of Agriculture, and the cordial coöperation of the Association of American Agricultural Colleges and Experiment Stations, it has been possible to put this enterprise on an efficient basis and the school therefore begins its sessions under most favorable auspices. Considering the character of its faculty and students there is every reason to believe that the entire session of the school will be filled with the most earnest teaching and the most thorough discussion of the subjects included in the course. In an unusual measure we believe this school will furnish inspiration and up-to-date knowledge to workers in our agricultural institutions gathered out of many States and Territories; but beyond this, we believe, that in its ultimate results this school will greatly aid in the formation of public opinion in favor of the more thorough and rational organization of agricultural education and research in the United States.

The school will aim to solidify and amplify the organization of education and research in agricultural subjects *on the basis of agriculture itself*, considered as both a science and an art. It will seek on the one hand to help on the movement for grouping the results of investigation in many scientific lines into a fairly well defined body of knowledge to be known as the science of agriculture, comparable with such sciences as geology, geography and medicine; and on the other hand to quicken and broaden the movement for the direct application of science in manifold ways to the art of

agriculture. While we expect to pursue our work with high standards of scientific and pedagogical effort, we will not for a moment lose sight of the farmer and the requirements of practical agriculture. All our labor will be counted as in vain if it does not issue sooner or later in the growing of plants and animals better adapted to the uses of men and the evolution of a system of farming in which the financial returns shall be more satisfactory to the intelligent and thrifty farmer, and under which the general level of intelligence, comfort and upright and harmonious living of our rural population shall be perceptibly and increasingly raised.

We believe that the wide movement for the establishment of agricultural schools, colleges, experiment stations, and departments of agriculture, from which already such important results have come, has in it vast potentialities not only for the bettering of the financial and other material conditions of the rural population, but also, and far more, for their intellectual and moral quickening. Wherever there is a definite movement by which men pursue systematic and long-continued investigations along the line of any industry, whether in the realm of administration, invention or science, with the result that the organization, processes and appliances of that industry are changed in the direction of more thorough system and greater complexity, there follows necessarily a higher intellectual activity and a more elevated morality in the mass of workers in that industry.

Our aim, therefore, is a high one and our inspiration to the most strenuous effort in the few weeks in which we are assembled in this school is a lofty one. We seek to lay the lines and set the pace by which the workers in the cause of agricultural education and research in every state and territory of this Union

and in the most distant island over which our flag floats shall march to the conquest of new facts and principles which may be utilized for the advancement of agricultural practice and the more efficient instruction of the farmer and his children along agricultural lines.

We shall be greatly disappointed if the faculty and students of this school do not carry back to the states from which they come a greater zeal and a more definite purpose to make their future study, investigation, and teaching more directly efficient in the service of agricultural education and research, and thus of agricultural progress. We expect that the results of the work done here will be felt in the national and state departments of agriculture, in experiment stations, in agricultural schools and colleges, in administrative offices and legislative halls, and on our farms. We shall have failed if our labors do not result in the better equipment of our agricultural laboratories, schools and colleges, in the more thorough organization of our system of agricultural education, in the institution and successful issue of more thorough researches, and in important ultimate results of practical value to our farmers. This may seem like a too ambitious program for so short-lived a school, but in the present quickened condition of the public mind regarding agricultural education and research, such meetings as this may do much to crystallize opinion and organize action. The signs all indicate that we are on the edge of a widespread movement to organize agricultural education in this country on a much broader basis in order that it may permeate the mass of our rural population. The people are looking to the agricultural colleges to lead in this movement. In a large way it may be said that the hoped-for leaders in this new enterprise are here assembled. Surely our councils

will have been futile if they do not give an impetus and direction to the plans for popular agricultural education already being formulated. The people are already offering our higher institutions for agricultural education and research relatively large sums of money and are evidently intending to give them more. One very important question for us to consider here is how we shall meet the increased demands and the expectations of our constituents. If we can find a way here to make the work of our agricultural colleges, experiment stations and Department of Agriculture in any respect more effective and satisfactory, we shall surely reap ample reward in increased material support for our instruction and researches and stronger popular confidence in our usefulness as instruments of agricultural advancement.

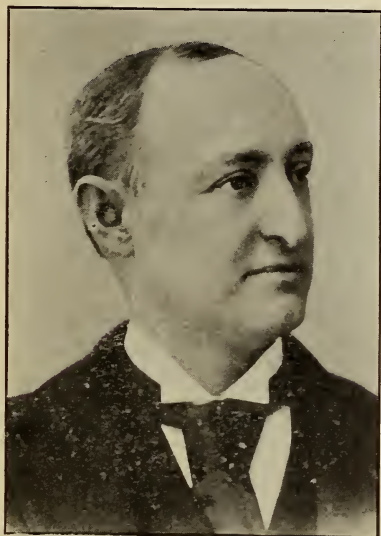
United States Department of Agriculture.

BY HON. JAMES WILSON,

Secretary of Agriculture.

The Department of Agriculture has become a post-graduate institution for students in applied agricultural science. Two thousand scientists are making research in every field in which producers are interested. The graduate of the agricultural college who desires to pursue investigations has a wide choice with regard to the single or group specialties into which he may wish to inquire. Congress is doing more for the farmers of the United States at the present time than is being done by any other legislative body on earth for the people of any country. The appropriations for the Department of Agriculture, directly and indirectly, are over \$6,000,000 annually. The combined incomes of the universities of Harvard, Yale, Columbia, Chicago and Leland Stanford, the best endowed colleges in the United States,

would but equal the appropriations made to the Department of Agriculture. And yet this appropriation represents but three-fourths of one per cent. of the vast total appropriations made by Con-



PRESIDENT H. C. WHITE,
Georgia.

gress for the support of all departments of the government.

The development of the Department of Agriculture to its present position within the last six years is the work of the American Congress, inspired by Presidents McKinley and Roosevelt. The appropriations have more than doubled within this period.

The question naturally arises, What is the department doing to justify appropriations equal to the combined income of the five best endowed universities in the country? Much of the department's work cannot be estimated in dollars and cents, but a brief statement of some results achieved by the department workers will answer the question in a way to satisfy the most critical.

About 20 per cent. of the appropriation for the department goes to the Weather Bureau, which guards the lives and property of our people on water and forecasts for producers on land what the weather is likely to be.

The Bureau of Animal Industry, that gets another fifth, guarantees the healthfulness of meats in interstate and international commerce and studies the diseases of animals with a view to their extermination. This work cannot be estimated in dollars and cents, but here are a few items indicative of the value of the scientific work of this bureau to the American people. The practicability of controlling Texas fever has been demonstrated and losses from that source are being prevented. Several million dollars annually are saved to the stockmen of the country by the bureau, by sending out a vaccine to check the ravages of blackleg among calves. At one time it cost 8 per cent. to insure animals crossing the Atlantic, but the supervision of ships having been placed in this bureau and better sanitary arrangements having been made, losses have become so few that insurance has dropped to one-half of 1 per cent., saving several million dollars more to the cattlemen of the country.

The encouragement given to growers of tea, figs, dates, prunes, macaroni wheat, rice and sugar, by the Bureau of Plant Industry, has increased the production of these articles within the last six years over \$27,000,000. These things we can see and estimate in money values. The growth in the next six years in all these products will be greatly increased. For example, two million bushels of macaroni wheat were grown this season throughout the semi-arid regions of the country. There is no reason why 100,000,000 bushels of this wheat should not be grown and not only completely supply the home demand, but leave a large surplus for export. Through the encouragement of the department, \$15,000,000 worth of sugar was produced last year from the sugar beet. A maximum crop would be over 40 tons to the acre, and 38 tons have been actually

grown. Twenty tons is not uncommon. The average crop in the United States at the present time is but 9.6 tons to the acre. Six years ago the United States produced one-third of the rice it consumed. The department has intervened and found varieties suitable to our Gulf Coast country—Louisiana and Texas—and the crop this year will fully supply the home demand and leave a considerable amount for export.

The crop has been increased in value over \$10,000,000 annually and the amount will be saved that we paid out before the department scientists gave the matter their attention. One American grows as much rice as 400 Orientals. We sell \$30,000,000 worth of low-priced tobacco annually, and we buy half that amount of high-priced wrapper and filler tobacco. The Department of Agriculture has shown the people how to produce the Sumatra wrapper tobacco, that has been costing us over six million dollars annually. One million dollars' worth will be grown in the Connecticut Valley this year and all wrapper tobacco in a few years. The growing of fine filler tobacco is being studied by the scientists of the department in four states of the Union, Pennsylvania, Ohio, Texas, and North Carolina, with a determination to master the principles that control production of this article and save over \$8,000,000 annually to the American people.

We cannot put a value on the work of the department scientists in the encouragement of fibers, fruits and vegetables which are being imported and developed by hybridizing. A threatened destruction of sea-island cotton by a fungus growth of the roots has been prevented after several years of study, and the development of new varieties by hybridizing gives promise of finer fibers and larger yields.

The Bureau of Soils has fifteen parties at work this summer in twenty-five states ascertaining the value, for staple crops, of our several soils. But a money value cannot be placed on that work while much misdirected effort will be saved in the future.

Over 100 scientists are studying forestry in the Department of Agriculture, and being educated for greater usefulness with regard to planting where there are no woods, more intelligent harvesting of the lumber crop, etc., in both public and private forests. But here again there is no way in which we can put a money value on the work.

The Bureau of Chemistry does work for all departments of the government, inquires with regard to the healthfulness of articles which form part of our interstate and foreign commerce, and so forth, but there is no way to put an estimate on the value of this work.

The Office of Experiment Stations arranges co-operation between the department and nearly all the state experiment stations of the country, supervises the scientific investigation of irrigation, and investigates the nutrition of man in all his vocations.

The Division of Statistics inquires into the crops of the country, so that the producer may know what the result is likely to be in regard to the great staples and come to intelligent conclusions as to the effect the volume of each crop will have on prices. The interchange of facts along this line with foreign countries is being arranged for, with a view to getting conclusions relative to the crops of the world for the benefit of the American producer.

The Division of Entomology inquires into our insect friends and enemies. Wherever an insect is doing damage our entomologist intervenes, makes diligent inquiry into the life history of the pest,

and informs the people regarding the best methods of prevention.

The entomologist sent one assistant to Japan a year ago to find the original home of the San Jose scale. He investigated that country for five months and found scales enough, but always in the neighborhood of imported plants. He then went to China and inspected the fruit trees near the coast and about the great trade centers. There he found scales in plenty, but also in connection with imported trees; he finally went to Tien Tsin, toward the great wall, and there found the scale associated with native plants, only doing little damage, being kept in subjection by its natural parasite. This parasite was gathered in large numbers and shipped to the United States. They will be sent to the localities where trees are suffering. We cannot estimate the value of this work, but it costs the department heavily.

The Biological Survey inquires into the distribution of animal and plant life as affected by latitude, the habits of wild animals and birds, and their value or detriment to the husbandman, besides ascertaining where plants, owing to natural conditions, can reach their maximum growth.

One of the distinctive features of civilization, or the want of it, is the condition of the public roads. The department has organized a scientific inquiry into the material for building highways, so that our people in the several localities of the country may learn what is the most valuable and most available for this purpose. No money value can be put upon this work, but its worth to the farmer is instantly apparent.

The people get the benefit of all these investigations through the Division of Publications, which has during the past fiscal year sent out ten million copies of over six hundred distinct publications, prepared mostly by the scientists of the

department. There are fifty-five experiment stations in the United States, sending out a total of half a million pieces of printed matter annually, regarding their scientific investigations. An estimate can be made of the work of the department when we find that it sends out twenty times as much printed matter as the fifty-five experiment stations.

I have said nothing about our explorers. Few of the staple crops of the United States are native to the soil. Our valuable plants have largely come from foreign countries, and this may be said also of our valuable animals, with few exceptions. We send some of our scientists as explorers into all the nations of the earth, looking for new trees, shrubs, grasses, legumes, grains, fruits and flowers for introduction into those parts of the United States to which they may be best adapted. One explorer goes to northern Russia and Turkestan for fruits and seeds supposed to be desirable. Another goes to Egypt for plants suitable to the alkaline soils of the far west. Another goes to Mexico to bring back some very successful peaches for introduction to parts of the United States where the peach has not succeeded. Another is in South America inquiring into markets for our finely bred animals, among other things. Another is in the China Seas, introducing our dairy products to the Orientals. One has just returned from a visit to India and Burma, China, Japan and the Philippines, for the purpose of bringing back forage plants for our southern states to diversify agriculture there. This statement illustrates the work that is being done along that line, but there is no way of putting a money value on it.

The department is gathering the seeds of valuable trees all over the country with a view to their propagation and distribution through members of Congress and directly by the department, to places where they may be most at home.

We buy from tropical countries \$200,000,000 worth of products annually that cannot be made to grow successfully in the United States. The island groups, lately come under our flag, have each a corps of scientists sent out from the department to help the people towards producing what cannot be profitably grown in the United States, with instructions not to encourage the production of things for export from their shores that can be successfully grown in the United States. Within a reasonable number of years, coffee, rubber, fibers, fruits, spices, etc., consumed in the United States, will be grown under our own flag, and will enable those peoples to buy more heavily from us in these new possessions.

A division of the department studies foreign markets. The heavy balance of trade in favor of the United States during the last few years is due largely to the producers from the soil, who send abroad 65 per cent. annually of our exports. We publish pamphlets devoted entirely to the movements of agricultural products and are at considerable pains to get facts that are not found in other statistical publications, official or private.

Congress has charged the department with the duty of maintaining the integrity of our export dairy products, as well as our export meats, so that foreign purchasers will in future be fully advised regarding them.

The department has had the reputation in past years of sending out valueless seeds. Within the last few years steps have been taken, with the authority of Congress, to test commercial and imported seeds, as well as all the seeds sent out by the department. So that in addition to gathering new seeds they get the very best that growers can produce.

A very interesting work is being done in far-away Alaska. This part of our country has climatic conditions similar

to those of Finland. The agricultural possibilities of this country are much greater than our people have generally supposed. The long days of sunlight up there grow perfect grains and vegetables that will be valuable for hybridizing to improve their kinds in the states and give us new varieties, and the time is not far distant when its agricultural products will greatly exceed the product of its mines.

The most valuable work of the department is the education of undergraduates and post-graduates for its work and that of the experiment stations of the country, who find scant provision for their instruction in our institutions of learning. We have many such students who apply facts as they are found; in fact the Department of Agriculture applies science to the farm, the forest, the orchard and the lawn and to everything related to them.

This is a brief outline of some of the work of the two thousand scientists of the department, who inquire of nature regarding the truths that have been undiscovered in the past and apply them to help the farmer.

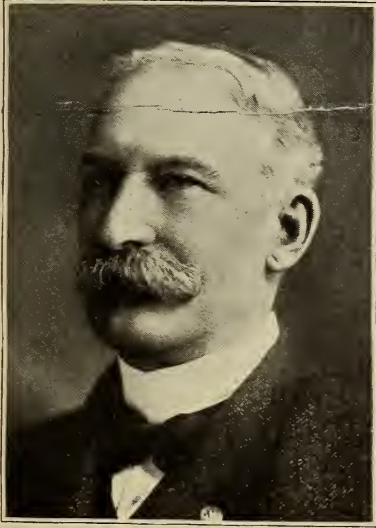
The American System of Agricultural Education and Research.

BY WM. M. LIGGETT,

Dean of College of Agriculture of University of Minnesota, and President of Association of American Agricultural Colleges and Experiment Stations.

The cordial and heartfelt words of welcome from President Thompson on behalf of the University and the great State of Ohio, come to us with peculiar force. For we can fully appreciate what the institution of this Graduate School of Agriculture means, not only to the Association of American Agricultural Colleges and Experiment Stations, but also

to the cause of agriculture in general. We must first express our thanks and then congratulate the University, its President, and the Dean of its Agricultural Department, upon the auspicious opening of the school.



WM. M. LIGGETT.

We also congratulate the Honorable Secretary of Agriculture that during his term in office this and many other advance movements in the work of benefiting the American farmer are being successfully instigated. We extend our congratulations to the Dean of this Graduate School upon the general co-operation he has enjoyed in his efforts to secure a faculty; and we felicitate all interested in the management of this school upon the number and character of the students who have come here for instruction and conference.

Agricultural education and research in this country have passed through several stages of development, and the system which has been evolved is, like all our institutions, strictly American in character. No other country or nation has a similar system of agricultural schools, colleges, or experiment stations. The American system has not, of course, reached perfection in any of its parts; but it has accomplished satisfactory re-

sults, and it is the *results* which should be considered in the measurement of its success.

The passage by Congress of the original Morrill Bill for the establishment of land grant colleges prepared the way for this great movement in agricultural research. At first there was a very indefinite idea as to what should be done with the funds appropriated. And here we are indebted to some of the European universities who sent us trained teachers and investigators, and to such of the older colleges and universities of this country as did pioneer work in equipping young men for faculty positions. Some of these older colleges may have failed, in a measure, to study the pressing agricultural problems of their time, but it is due them to say that they *did* send out skilled investigators equipped to grapple with the problems of today. And the training which some of our teachers and investigators received abroad has had a powerful influence in formulating, if not molding, the policy of our educational and experimental work. But on the whole, the American system of agricultural education and research has been built mainly upon an experimental basis,—which certainly forms a broad and solid foundation.

It is not my purpose to describe the structure or mechanism of this system, as you are all more or less familiar with this phase of the subject. But I will turn, rather, to the outgrowths of the system and some of the more salient factors which have contributed to its success.

Among these factors the liberal policy pursued by the governing boards of our most progressive agricultural colleges has been conspicuously important. This attitude on the part of managing boards has supplied one of the main reasons for the rapid development of these institutions. Where the policy has been nar-

row or hostile, failure has been the result. So long as an agricultural college is hampered for funds, or while the progressive ideas of its faculty are met with lack of sympathy from the governing body, just so long must it continue to be the poorest department of a university.

Generous support and patronage on the part of the people have been in recent years decidedly influential in the substantial progress made in all matters pertaining to agricultural education and research.

During the past twelve or fifteen years there has been a decided change in public opinion regarding the agricultural professor and the agricultural profession. The professor in the agricultural college is no longer considered a fit subject for ridicule and jest, but his teachings and ideas in general are respected.

Another most important factor in the success of our American system, has been the excellent personnel of the faculties and corps of investigators in many of the colleges and stations. Money and public support cannot make an institution a success without the right kind of workers. The professors and instructors make a college more than the endowment. So in an experiment station, it is the character and work of the corps of investigators, more than the size of the income, which determines the station's success.

A true station worker is a *man* in every sense of the word. He puts his character into his work. He is not of a covetous or quarrelsome disposition, but always rejoices in any success of his co-workers and colleagues, and in the work of other institutions. He should lose sight of all selfish motives, and if necessary, be willing to put aside his individuality for the advancement of any piece of work that may be of value. This does not mean that in the plans which come up in his department he is to have no voice in their

planning, management or execution, but that "all should work together for the good of the whole."

Some stations have failed to make a success of their work because of internal strife, petty jealousies, and lack of harmony among the staff. *Co-operation* should be the motto of every station.

This Graduate School of Agriculture will be of inestimable value, if nothing farther than the promotion of co-operation is accomplished. It is a pleasure to see professors, investigators, instructors and students all come together on common ground to seek for knowledge. It is fitting that it should be so. Acquaintances will be formed, methods will be compared, fallacies will be pointed out, and a better understanding will be secured among workers in agriculture.

In the nature of things the work of the experiment station must be public property. The stations are instituted by the people and for the people. The workers are paid to develop facts, processes and methods for the use of the people. A recent magazine article, in referring to the discovery of the Babcock test, says: "One significant sentence in the preliminary bulletin, issued immediately after the discovery, is worthy of special notice. It reads: 'This test is not patented.' This is the keynote of the success of these institutions. There is no patent, there is no private gain, there is no monopoly—it is all absolutely free to the world."

This is a peculiarly just estimate and conclusion, and with a few exceptions the workers in the agricultural colleges and stations have this true scientific spirit. I trust that the young men who are here will endeavor to cultivate it. And at the same time do not neglect to keep in touch with the needs and requirements of our farmers, and above all cultivate good common sense so that when you write a bulletin and it is read

by a farmer he may be able to understand it and profit by your labors.

Consider any important discovery which has been of benefit to agriculture and you will invariably find that, coupled with the peculiar individuality of the investigator, it was some institution instructor or group of instructors which gave the initial impulse. Numbers of the younger men attending this school, will, no doubt, receive encouragement, suggestions, and inspiration which will be fruitful.

While I have mentioned some of the main features which have contributed to the success of our American institutions for agricultural education and research, I wish also to briefly mention some of the results that have been obtained.

On the perplexing problem of the conservation of the fertility of the soil, the work that has already been done has thrown much light. As the result of experiment station work, larger yields per acre, have been secured from lands that had formerly produced scant crops. The ideas advanced by vague theorists that the human race would, in a century or so, starve because of soil exhaustion, are no longer seriously entertained by scientists.

Progress has been made in the improvement of many of our farm crops, particularly corn and wheat, by seed selection, breeding and cultivation. New varieties are produced which are suitable for different climatic and soil conditions.

Ways have been provided for the protection of crops from insect ravages. The "grasshopper plague," the ravages of the chinch bug, the army worm, and other destructive insects no longer are such menaces as they were years ago.

Animal foods are produced more intelligently and economically. A larger list of valuable forage crops is now at the disposal of the farmer. In case of spring drouth, ways have been pointed out by

which late summer and autumn forage can be produced.

In the feeding of farm animals and the production of milk, butter, cheese, beef, mutton, pork, lard, bacon, wool, poultry, and eggs, substantial progress has been made. Feeding stuffs are selected and purchased more intelligently, and their composition and value are better understood by people in general. Ten years ago the words "protein" and "carbohydrates" were rarely seen in agricultural papers, while now they have become common terms.

Progress has been made in the improvement of farm animals by breeding, although less advance has been achieved by stations in this direction than in others. In animal breeding, results are secured more slowly than in plant breeding or other experimental lines.

The production of fiber crops has received its share of attention. Cotton is raised, protected from insects, and marketed, more intelligently than formerly as the result of station work.

Animal diseases are held in check and treated more successfully. The importance of sanitation, the relation of animal to human diseases, and the prevention of diseases rather than their cure, are some of the problems which have been undertaken by station veterinarians.

The investigations relating to human foods and the nutrition of man have been of particular value, not only to the farmer, but to the average wage-earner as well. The laws underlying the subject of nutrition are gradually being interpreted, and better and more economical foods are now within reach of the working man than would be possible if no experiment station work had been done.

As the result of studies in practical forestry, the forest crops are, to some extent, being grown and handled in a systematic and business-like manner instead of destructively as heretofore.

The farmer is being protected from frauds as the result of experiment station work. Quack preparations and patent nostrums have a smaller sale than formerly. In the way of exposing frauds alone, the stations have saved large sums of money to our people.

In the manufacture of agricultural products, particularly butter and cheese, the stations have assisted the farmers in making a higher grade of goods and in handling these articles in a more satisfactory way.

Time will not permit me to mention *other important* lines of work in which results have been secured, such as reclaiming alkali lands, improving fruits and vegetables, and the introduction of new varieties of crops.

A large amount of work has been done upon all of these lines. The financial returns to the people from any one of the many results enumerated have been greater than the total cost of the stations. No one line of investigation can be said to be more important than another. The experiment station work has touched nearly every phase of agriculture. Improvement has been manifested on all sides—soil improvement, crop improvement, and even the improvement of man.

As the experiment stations become older, and as they improve their work by increasingly valuable discoveries and results, they will be held in correspondingly higher esteem by the people. Without the work that has been done by the stations, large public enterprises, such as redeeming the arid lands by irrigation, could not have been undertaken.

The experiment stations offer many attractions to young men who are properly equipped for the work. The station worker of the future, however, needs to give careful preparation to his chosen profession. There has been a tendency, on the part of many, to specialize too

early and neglect the broad liberal education that is so necessary before specialization should be undertaken.

The results obtained, in agricultural education, have been fully as significant as those secured in station and research work. Agricultural colleges which fifteen years ago had only a half dozen students, now have from fifty to one hundred, and agricultural schools which were then unheard of, now have hundreds of students.

I believe that the logical development of the educational system will be along lines which are already blocked out in some of our institutions. There will be the agricultural high school which will take the farmers' boys and girls when they have completed the grammar school grades, and give them three or four years of high school work which will fit them for farm life and work. The course in the agricultural high school includes a continuation of the common branches in connection with technical studies adapted to the age of the student and the possibilities of practical results. For instance, chemistry must go far enough to teach the analysis of foods and soils; botany must be the foundation for the study of many kinds of plant life and the practical work of planting, cultivating and harvesting; entomology must teach at least the general character of the insect friends and enemies of the farmer, and the means of employing the one and destroying the other. There must be practical shop study of carpentry and blacksmithing, actual work in the dairy, technical instruction in animal breeding and the selection and care of stock, and experimental work in laboratory and greenhouse. In fact, all the work must be intensely practical and there must be opportunity for practice and observation of actual method at every turn.

The object of the agricultural high school must not be to turn out finished

scientists, but rather to give to the average farmer's boy a practical fitting for his life work—such a fitting as the technical schools give to the boys who attend them only to perfect themselves in a chosen trade.

But it is obvious that such a school is the best secondary school for the young man or woman who desires to become a scientific agriculturist. For this reason the course in the high school should lead as directly as possible to the college course. Of the latter I need not speak at length to the present audience. No field for the useful exercise of trained faculties has ever been more attractive than that which now opens before the agricultural scientist. And further, there is a demand for his services which makes it probable that he can soon command a compensation quite commensurate to his talents.

Besides the college and high school work important progress has been made in the development of dairy schools, short courses in agriculture, farmers' reading courses, and other lines of agricultural education. The farmers' institutes in many states have done excellent work. Text-books and farmers' manuals have been prepared which have been of value in all this educational effort.

The field of activity in agricultural education is almost limitless. New things and good things are being constantly proposed. In fact there is so much that can be done by the ambitious professor or station worker that the present tendency is to undertake too much and to carry on too many lines of work. In many colleges and stations better results could be secured if the work were more concentrated and unified. Concentration and co-operation should be the watchwords in all station and college work in the future.

While the institutions for agricultural education and research have made great

progress and brought forth good results during the past decade, it should be remembered that they have but *entered* upon their work of usefulness. Many unsolved problems remain to be considered. But the future of the agricultural college and stations is bright; for it rests with the workers. These workers will do their part, I am confident. The good attendance which marks the opening of the Graduate School of Agriculture is one of the best indications of the enthusiasm and earnestness which characterize the work of college and station men. In this earnestness and enthusiasm lies the guarantee of a constantly increasing usefulness and achievement under the American System of Agricultural Education and Research.

The Science of Agriculture.

~~Saturday Conference, by A. C. True, Dean.~~

In order to make an intelligent and correct answer to the question whether there is a science of agriculture, we must first clearly understand what is meant by the terms "science" and "a science." For this purpose we may fairly appeal to books of reference in common use, which have been brought reasonably well up to date, so that they may be taken as expressing the consensus of scholars on this subject in our day. I ask your attention, therefore, first to the definition of science given in Johnson's Encyclopedia—revised edition.

"SCIENCE. In a general sense, knowledge reduced to order; that is, knowledge so classified and arranged as to be easily remembered, readily referred to, and advantageously applied. All science is based on the assumption that the laws of nature are immutable. From this point of view science may be regarded as a knowledge of the laws of nature, embracing the process of experiment, observation, and comparison, by which

they are discovered, and the modes of reasoning by which their operation in the production of phenomena is made known. Hence most widely it signifies the knowledge of a truth in relation to other truths."

Next let us examine the definitions of "science" and "a science" given in the Standard Dictionary:

"SCIENCE. (1) Knowledge gained and verified by exact observation and correct thinking, especially as methodically formulated and arranged in a rational system; also, the sum of universal knowledge.

Science in the wide sense includes (1) *science proper*, embracing (a) exact knowledge of *facts* (historical or empirical science), (b) exact knowledge of *laws*, obtained by correlating facts (nomological science), and (c) exact knowledge of *proximate causes* (rational science); and (2) *philosophy*. In the narrow sense of positive science the word is used as including only the first two divisions of science proper.

"A SCIENCE. (2) Any department of knowledge in which the results of investigation have been worked out and systematized; an exact and systematic statement of knowledge concerning some subject or group of subjects; especially, a system of ascertained facts and principles covering and attempting to give adequate expression to a great natural group or division of knowledge; as, the *sciences* of astronomy, botany, chemistry and medicine; the *science* of theology."

We may, then, have a "science of agriculture" provided there is a body of knowledge about agriculture which has been "gained and verified by exact observation and correct thinking," and "in which the results of investigation have been worked out and systematized."

This science should embrace (a) an exact knowledge of *facts*, and (b) an ex-

act knowledge of *laws*, obtained by correlating facts.

But there are different kinds of *facts* and *laws*, and in order to see what is the real character of the Science of Agriculture and its relation to other sciences, it will be well to make at least a rough classification of sciences.

There are, first, the mathematical and physical sciences which deal with the facts and laws of number and space, and the properties of matter. The mathematical sciences are algebra, arithmetic, geometry. The physical sciences, considered as the sciences which treat of dead matter, or of energy apart from vitality, are astronomy, mechanics, physics, and chemistry.

These sciences which deal with the ultimate constitution of matter may for our purpose be termed Primary Sciences.

Some may also consider biology, as the science of life or living organisms, as a primary science; but as a matter of fact, we study under the head of biology very largely the physics and chemistry of the matter comprising living organisms, so that biological sciences are really complex sciences which deal not so much with the ultimate constitution of matter and life, as with secondary facts and phenomena as revealed in living organisms. They belong, therefore, to what may be called Secondary Sciences.

Thus physiology is very largely the physics and chemistry of the plant or animal, as mineralogy is the physics and chemistry of minerals. These secondary sciences, of course, have their descriptive side, under which the objects with which they deal are described and classified. Among the Secondary Sciences are botany, zoology, physiology, mineralogy, etc.

There is a third class of sciences which are of a still more complex nature, dealing with large complex objects or groups of objects, and making use in special

ways of the facts and laws included in the primary and secondary sciences. Such for example are the sciences of geology, geography, and medicine; and in this class I would also put the science of agriculture. For our purpose at least, we may call these sciences, Tertiary Sciences.

Without doubt greater refinements of classification would be required if we were making an exhaustive study of the relations of the various sciences to each other. We should at the outset of such a study find great difficulty in exactly defining the boundaries of each science, for the more closely we study the different forms and groups of matter and living organisms, the more clearly we see the intermingling and overlapping of laws and phenomena. The relations of this to our present subject I shall briefly consider later. It will, however, help to remove difficulties in defining the science of agriculture if we keep in mind the somewhat rough and ready classification of sciences, which I have made into three groups—Primary, Secondary, and Tertiary.

The primary sciences are those which deal with the constitution of things.

The secondary sciences are those which classify and describe natural objects and explain their constitution and functions—on the basis of the primary sciences.

The tertiary sciences are those which deal with aggregations of natural objects

correlated so as to form a natural or artificial system, which may be described as a whole, and the constitution and functions of which may be explained on the basis of the primary and secondary sciences.

From the complex and diverse nature of the systems with which the tertiary sciences deal it is hardly to be expected that they can be satisfactorily classified, or that they will individually permit of rigid and adequate definition. It will always be somewhat difficult to differentiate them absolutely from the sciences underlying them, but in this respect they differ only in degree from the primary and secondary sciences. In the development of modern science, with its almost limitless ramifications and the numerous points of view from which scientific investigations may be pursued and their results recorded, it is no longer possible to make logical and fixed boundaries for particular sciences. Whether the science of nutrition, for instance, shall be considered physiological chemistry or chemical physiology or a branch of biology—either botanical or zoological—will depend a good deal on the point of view of the scientist defining it.

Nevertheless, I believe it is possible to sufficiently differentiate the individual tertiary sciences so that they may be considered as organic wholes rather than mere aggregations of underlying sciences. And, as I shall endeavor to show later, I deem it very important that they should be thus differentiated and studied. Let us, therefore, examine the definitions which may fairly be given to some of these tertiary sciences.

GEOLOGY (Science of Lithosphere): GEOGRAPHY:

Dynamic Geology.
Petrography.
Structural Geology.
Physiography.
Historic Geology—
Stratigraphic.
Paleontologic.
Economic Geology.
Geologic Technology.

Mathematical (a) Astronomical.
(b) Math. proper { Geodesy.
Topography.
Cartography.
Physical (a) Physiography.
(b) Hydrography.
Political (a) Ethnography.
(b) Ethnology.

MEDICINE:

Pathology.
Medical Chemistry.
Pharmacology.
Therapeutics.
Surgery.
Hygiene and Sanitation.
Medical Jurisprudence.

AGRICULTURE:

Plant Production { Agronomy { Breeding.
Horticulture { Culture.
Forestry { Preservation.
Zootechny { Mammaliculture { Breeding.
Aviculture { Nutrition.
Pisciculture { Management.
Apiculture {
Sericulture {
Agrotechny.
Rural Engineering.
Rural Economics.

Geology, as the science of the earth, or more strictly of the lithosphere, may be subdivided as stated on page 205. "It is related to physical geography, the science of the surface. This relation is peculiarly intimate because the same series of changes which have produced the texture and structure of the crust have also produced the forms of the surface, so that the processes of change belong alike to dynamic geology and physical geography; and physiography is claimed by both sciences. Mineralogy, though strictly a department of chemistry, is interwoven with petrography, and their relations are doubtless destined to become still more intimate as the genesis of rocks and minerals comes to be better understood. Paleontology, though an inseparable part of historic geology, is equally inseparable from biology; but while neither affiliation can be abandoned, there is a well-developed tendency to divide this science into two parts—biologic paleontology, being concerned chiefly with the sequence or evolution of living forms as illustrated by fossils, and geologic paleontology with the association of fossils in faunas and floras."

"*Geography* is, literally, a description of the earth. This is *General Descriptive Geography*. But the great process of physical and natural science, as well as of the science of man in all his conditions, has awakened a desire for a higher, more comprehensive, and intelligent knowledge of the earth. To describe without rising to the causes and descending to the consequences of the phenomena is not science. The reflective mind craves more. While studying the earth in its natural aspects, it wishes to learn why these natural phenomena are as they appear, how they are produced, and what laws govern them. It seeks to understand the relations of mutual dependence that binds them together, as causes and effects, into a vast system, into one great individual mech-

anism, which is the terrestrial globe itself, with all it contains. Such a science must endeavor to discover those incessant mutual actions of the different portions of physical nature upon each other, of inorganic nature upon organized beings—upon man in particular—and upon the successive development of human societies; in a word, to study the reciprocal action of all these forces, the perpetual play of which constitutes what might be called the life of the globe. This is *Scientific Geography*, which may be defined as the science of the general phenomena of the globe, and its life, in reference to their connection with mutual dependence.

"It may be asked whether a science which thus embraces the whole domain of nature and man has a claim to an individual existence; but when geology has taught the composition of the earth's crust and the history of its gradual formation, physics, the laws which govern matter; when botany and zoology have classified the plants and animals according to their affinities and differences in a grand system of life; when ethnography and history have done their special work it still remains for geography to trace out the relations of these various orders of things to each other. Geography needs the results of all these sciences, but is not to be confounded with them.

"*Geography*, as the science of the earth, is naturally divided into three great departments, corresponding to three orders of facts: The earth considered as a planet, a part of the solar system, or *Astronomical Geography*; the earth considered in itself, the *Geography of Nature*, or *Physical Geography*; the earth considered as the abode of man, the *Geography of Man*. These three departments are usually called *Mathematical*, *Physical*, and *Political Geography*."

I have given this account of *Geography* because it illustrates very well on

what broad lines a tertiary science may be constructed. Geography, as a science in this modern sense, is of very recent date and has hardly yet passed the time of struggle for recognition as a distinct science. This is not remarkable, because the new science of geography embraces material drawn from many sciences—mathematics, physics, botany, zoology, geology, astronomy, meteorology, ethnology, statistics—these at least are embraced in geography, and there have been many scientists (of whom a few remain unto this present day), who have claimed that geography was merely a loose aggregation of materials drawn from different sciences, and should therefore not be considered as a distinct science. Others have claimed that it was merely a branch of some existing science, e. g., astronomy or geology. But as geographers have kept at their work and have elaborated and correlated the different parts of the science of geography, the distinctiveness of this body of knowledge has become more apparent and the advantages of studying the subjects included in geography in a systematic way according to their groupings as geography have been more clearly revealed. Hence in our best institutions for higher learning, instead of being contented with giving the student instruction in the sciences related to geography, special and distinct courses in geography are being offered, and it is coming to be recognized that even the teachers of elementary geography should have special training in the science of geography in the normal school, or the college or university.

The *Science of Medicine* is one of the tertiary sciences, which, like the science of agriculture, has been profoundly affected by recent researches in other sciences. It is, therefore, in process of reconstruction. And one marked effect of the remarkable widening of the scientific

basis of the *practice* of medicine has been that the *science* of medicine has lost that clear-cut definition which in past times it was thought to have. For this reason, while there are numerous old treatises in which elaborate classifications of the science of medicine are set forth, such classifications have almost entirely disappeared from the recent literature of medicine. At the same time we have in medical institutions and treatises an advancing elaboration and differentiation of courses and subjects bearing on the science of human disease and its prevention or cure. On the basis of a thorough study of the constitution, morphology, and physiology of the normal human being, the modern science of medicine embraces Pathology, (anatomical and physiological), Medical Chemistry, Pharmacology, Therapeutics, Surgery, Hygiene and Sanitation, and Medical Jurisprudence. Medicine is then a science which uses materials drawn from many sciences. These materials are grouped in new and special ways with reference to their ultimate usefulness as a basis for an art or practice. This practice is clearly differentiated from the science and yet indissolubly united with it. In this respect medicine and agriculture are comparable. In the case of both there is a science, now as we believe on a sound basis and rapidly developing along right lines; but there is also a practice, which is every year being more profoundly and beneficially affected by the science which explains the principles on which its processes are founded, and which reveals the facts and laws by means of which its operations may be further improved.

The *Science of Agriculture* is that body of knowledge (gained and verified by exact observation and correct thinking, methodically formulated and arranged in a rational system) in which the facts relating to the production of plants and

animals useful to man, and the uses of these plants and animals are accurately set forth and a rational explanation is given of the phenomena and laws involved in such production and uses. It is obvious that this body of knowledge may be variously subdivided, according to different purposes of study or application. But in order to bring out more clearly my conception of the science, I shall now attempt to make and define one series of subdivisions.

Agriculture, as the Science of the production and uses of plants and animals useful to man, may be divided into Plant Production, Animal Production or Zootechny, Agricultural Technology, or Agrotechny, Rural Engineering, and Rural Economics.

Under Plant Production is included whatever relates to the natural or artificial environment (*i. e.*, climate, soil, water, fertilizers) of useful plants, their structure, composition, physiology, botanical relations, varieties, geographical distribution, culture, harvesting, preservation, and uses, and the obstructions to their growth, preservation or use. Plant Production may be subdivided into Agronomy, which deals with what are commonly called field or farm crops; Horticulture, which deals with vegetables, fruits, and ornamental plants, especially as grown in gardens, small plantations or parks, and Forestry, which deals with trees and shrubs grown in large tracts. It is obvious that the boundaries of these divisions of Plant Production cannot be very exact. Whether sweet potatoes or beans shall be called agronomical or horticultural crops will depend largely on the conditions of their culture; and whether a certain kind of tree shall be considered a forest tree or an ornamental plant, will depend on the method of its culture and its use. The science of plant production derives its materials from meteorology, agricultural physics and

chemistry, economic botany, bacteriology, vegetable physiology and pathology, economic entomology, economic zoology, and perhaps from other sciences. But these materials may be grouped in their relations to the processes involved in the production and uses of different kinds of plants, so as to form a distinct body of knowledge fairly entitled to the name of Science of Plant Production as one of the divisions of the Science of Agriculture.

The Science of Plant Production may be subdivided either according to groups of plants as suggested above, *i. e.*, into Agronomy, Horticulture and Forestry, or along other lines, *e. g.*, Plant Breeding, Plant Culture, Plant Preservation. Thus the plant breeder may be differentiated from the plant physiologist, as a man who is an expert in the science of improving the varieties of useful plants for particular purposes, taking into account the climate and soil in which the plants are to be grown, and the economic uses to which they are to be put. He must be a plant physiologist; but if he is only that, he will not be a successful plant breeder. The plant culturist should understand the physics and chemistry of soils, the botanical relations and physiology of useful plants, the uses to which these plants are devoted, and the weeds, fungi, bacteria, insects, and other pests which may impede their growth. He must know all this in relation to the problems of the growth of plants under the actual conditions in field and greenhouse, or he has not mastered the science, to say nothing of the art of Plant Culture.

The second great division of the Science of Agriculture is Animal Production, or Zootechny. This includes whatever relates to the anatomy, physiology, zoological relations, domestication, types and breeds, breeding, feeding, hygiene, management, and uses of useful ani-

mals. It may also include the science which treats of diseases and other impediments to the production of animals, i. e., Veterinary Science, though this is in itself a large and distinct body of knowledge, and bears only the same relation to Zootechny that the Science of Medicine bears to Anthropology. Zootechny may be subdivided according to the kinds of animals studied, into Mammaliculture, Aviculture, Pisciculture, Apiculture, Sericulture, or into such branches as Animal Breeding, Animal Nutrition, and Animal Management.

Agrotechny includes whatever relates to the conversion of raw materials produced in agriculture into manufactured articles for use in commerce and the arts. It may also include the processes of handling these raw materials in connection with their commercial uses, as in the case of milk and cream sold for consumption. It also involves whatever relates to departures from standards set for manufactured articles, i. e., adulterations and sophistications, in somewhat the same way that the diseases of plants and animals are related to Agronomy and Zootechny. Agrotechny is naturally divided into specialties according to the kinds of materials, e. g., Foods and Feeding Stuffs, Liquors, Oils, Textiles, Leather. The subdivision of most importance as a subject of school instruction in the United States is dairying.

Rural Engineering includes those branches of civil and mechanical engineering which relate to the locating, arranging and equipment of farms, and the construction and operation of farm implements and machinery. It embraces the surveying of farms, the location of farm buildings and works, the construction of buildings, water, irrigation, drainage and sewage system, and roads. It also involves the principles of mechanics as applied to farm machinery, and the use of different kinds of power

for agricultural purposes. As a branch of the Science of Agriculture it involves an understanding of the requirements of the plants and animals to be grown and used on the farm, as well as the needs of the human inhabitants as related to engineering problems.

Rural Economics may be more or less broadly defined according to the point of view. It at least includes whatever relates to agriculture considered as a means for the production, preservation, and distribution of wealth by the use of land for the growing of plants and animals. It may include development of agriculture as a business (history of agriculture), as well as the facts and principles of farm management under present conditions. If formulated and studied in its relation to the production and uses of useful plants and animals, Rural Economics may fairly be claimed to be a branch of the Science of Agriculture, though the same facts and principles may easily be so grouped as to make a subdivision of Political Economy or Sociology.

It should be understood that, while insisting on the existence of a real Science of Agriculture, I do not claim that the boundaries of this science can be determined with anything like mathematical precision. But this is, as has already been said, also true in greater or less degree of all the sciences.

It is also true that in making subdivisions of any science, scholars do not now insist on rigid divisions, or attach any very great importance to any particular scheme of classification. But when this has been granted it must be insisted upon that for such purposes as the organization of courses of study and the administration of great institutions of research, there should be the recognition of such sciences as Geology, Geography, Medicine, and Agriculture as the basis for the organization of the curricu-

lum or the administrative system. For practically a good deal depends in our colleges and scientific institutions on the point of view of the managers, teachers, and investigators. As long as we admit the non-existence of a Science of Agriculture, and are satisfied with aiding agriculture through teaching and investigation in the sciences related to agriculture, we shall have boards of trustees and college presidents who will be satisfied when their chemists, physicists, and botanists add to their ordinary teaching of the principles of chemistry, physics, and botany, a limited amount of information regarding the application of those sciences to agriculture; and the teachers themselves, approaching the subject from the standpoint of the primary or secondary sciences, will be most likely to subordinate the agricultural side of their instruction to the general view of their favorite science; so that the pupils will learn a great deal more about the relations of agricultural subjects to botany or chemistry, than they will about the relation of botanical and chemical knowledge to the production of useful plants and animals.

The establishment of such an organization as the Bureau of Plant Industry in the Department of Agriculture, marks an immense gain, not only in effectiveness of administration, but in the relation of the scientific effort of the investigators to agriculture. Now the men in that bureau feel that they are working primarily as agricultural scientists rather than merely as botanists. Their outlook towards their work is changed; there is a disposition to lay under contribution every science required to work out the complex problems of agriculture—and there is every reason to believe that they will accomplish for the science of Plant Production, as part of the Science of Agriculture, what that great bureau known as the Geological Survey, has

done for the Science of Geology. All questions regarding the exact boundaries of the Science of Agriculture or of its subdivisions, sink into insignificance when compared with the substantial fact that there is a rapidly increasing body of knowledge which fairly constitutes a Science of Agriculture, and that by organizing our colleges of agriculture, experiment stations, and Department of Agriculture on the basis of this science we may secure such increased efficiency of work and administration that we shall greatly widen the scope and thoroughness of this science, and through its effective application to practice in an ever-increasing number of ways, do more to improve the art of agriculture, thus benefiting the farmers, and through them all mankind, than would ever be possible as long as there were simply fragments of knowledge regarding agricultural subjects scattered through a score of sciences.

The fact that there is an art of agriculture, and that this art in its cruder forms involves comparatively simple operations, in no way militates against the need and feasibility of having a science of agriculture. There is a practice of medicine as well as a science of medicine. In his simpler work the doctor or the surgeon performs many simple manual operations which have been similarly performed for thousands of years, and long prior to the formulation of any science of medicine.

We readily grant that the operations of agriculture may be performed by persons ignorant of the science, but it is already evident that a right knowledge of the science may be very helpful in the practice of the art. It is also becoming apparent that the teaching of chemistry, botany and zoology, even on their economic sides, is not enough to satisfy the needs of agriculture. There must be teaching of the Science of Agriculture as such, from the university down.

The method of my present discussion of the Science of Agriculture has been chosen because there are still those who rank high in scientific and pedagogical circles, who claim that there is no such thing as a Science of Agriculture, and this view of the matter has not only had great influence in shaping courses of instruction and methods of investigation along agricultural lines in the past, but is still operating in our colleges and experiment stations to prevent the formulation of vastly better courses of instruction and methods of investigation in these lines.

Without doubt, the theoretical and practical denial of the possibility of a Science of Agriculture has had much to do with the comparatively slow growth of the Science, and the present unsatisfactory condition of agricultural instruction in many of our colleges. Nevertheless, a Science of Agriculture has been developed, and has already reached such a stage that its claims are each year being more distinctly recognized in our agricultural colleges.

The differentiation of the body of knowledge, which may fairly be called the Science of Agriculture, from the other sciences will lead to profound changes in the methods of teaching agricultural subjects, the equipment for such instruction, and the arrangement of courses to meet the needs of different classes of students. We are, in fact, already in the midst of such changes. The most obvious results of this movement thus far are the division of the subject of agriculture among several instructors in each college, so as to make at least the beginnings of a real agricultural faculty. Thus we now have quite commonly in our agricultural colleges professors of agronomy, animal husbandry (zootechny), dairying, horticulture, and veterinary science. When a group of instructors is thus formed the natural conse-

quence is a special building in which they may work, to a certain extent at least, in co-operation. When the building is provided it is seen to be appropriate and desirable that it should contain special arrangements, facilities, apparatus, etc., suited to the requirements of the subjects to be taught in it. This leads the instructors in several branches of agriculture to set their wits to work to devise special arrangements and apparatus which will improve the quality and thoroughness of their instruction. Along with this there is more study of the relation of the different topics to each other in a scheme of instruction, the rearrangement of courses, the improvement of methods of teaching, and the discussion of the whole subject of the pedagogy of agricultural science. Such a ferment and development is already making trouble for the presidents and boards of trustees of our agricultural colleges. The simple and inexpensive facilities which have hitherto sufficed for agricultural instruction will no longer do. Agriculture claims, and is now in a position to rightly claim, the same kind of treatment as is now quite generally accorded to Engineering and Mechanic Arts. If the teachers of agriculture are really alive to their business and successful in their endeavors to systematize their subjects and improve the quality of their teaching, they will devise and develop methods, apparatus, and illustrative material which will call for an increasing amount of money to properly house and maintain. We shall have failed in one of the great purposes of this summer school if the teachers of agriculture here assembled do not return to their respective institutions better prepared and more earnest to contend in every proper way for the development and increase of the agricultural faculties, and the facilities for agricultural instruction. This is not a matter of fine buildings and extensive fields. The real

problem before the agricultural faculties is to devise more and better apparatus, to discover far better methods of utilizing the college farm as a real agricultural laboratory, to provide live stock rooms and barns, and plant houses which will be of more real use as aids to instruction. The more the teachers of agriculture show they have grasped the pedagogic principles involved in the proper presentation of their subjects to students, and the more they collect and utilize appropriate apparatus and illustrative material, the easier it will be to get for them proper housing and equipment. What we need especially now are active, original, and ingenious teachers. Really competent men have a better chance of great success than ever before.

Meanwhile the investigations in progress in experiment stations and the Department of Agriculture and kindred institutions are rapidly widening the boundaries of the science of agriculture, and increasing the material for instruction. Those men who are sifting the results of these investigations and writing books and other summaries, are performing a very useful service. The Science must have a form and body in literature before it can hope for general recognition. Its claims are being recognized in a hopeful way by the editors of dictionaries, cyclopedias, and other general works of reference. The great *Cyclopedia of Horticulture* marks a distinct gain for the cause of agricultural science, and will, it is to be hoped, soon be supplemented by a *Cyclopedia of Agriculture*.

There need be no fear that the elaboration of the Science of Agriculture, the definition of its relation to the primary and secondary sciences, and the making of more thorough and severe requirements for courses in Agriculture in our colleges will stand in the way of broadening the field of agricultural instruction so as to make it reach the great body of

our youths in agricultural communities who, from the necessities of their condition and environment will not be able to attend our colleges. On the contrary, the more definite the Science of Agriculture is made, and the more thorough the pedagogics of agricultural instruction become, the easier it will be to provide good text-books and manuals for elementary instruction in agriculture, and to prepare courses and teachers of agricultural subjects for the lower schools. Hand in hand with the improvement and definition of the Science of Geography, the establishment of university courses on this subject, and the enlargement of geographical research, has gone the improvement of the text-books and manuals of geography in all grades of schools, and the betterment of teachers and facilities for instruction in this subject. The lowest grades of schools as well as the highest, have realized beneficial effects from the thorough overhauling of geographical science which the past quarter of a century has witnessed. And so it will be with Agriculture. As definite results of investigation accumulate, as college courses are improved, as thorough treatises on agricultural science multiply, it will be easier to devise effective and useful nature-study lessons in agricultural subjects for our elementary schools, suitable outline courses in the theory and practice of agriculture for our high schools, and good secondary courses in general agriculture, in horticulture, in dairying, and in other special branches for the special agricultural schools, which have already been so successfully conducted in a few places, and which we hope and expect to see established before long in many agricultural regions of our country.

I have spoken of these things because I deem it of great importance at this juncture that our teachers and investigators should regard the definition and

formulation of a Science of Agriculture as a matter of prime importance. For with the establishment and general recognition of such a science will come, not only the broadening and strengthening of institutions for higher research and education in agricultural subjects, but also a vast widening of the range of agricultural education, until it permeates the mass of our rural population and shows its beneficial results in the general elevation of the intellectual activities of our agricultural people, as well as in the improvement of the material conditions and gains of our agricultural practice. For the Science of Agriculture is one of those peculiar products of our broader and better conceptions of the field and office of Science. It exists not for itself alone, but rather for the betterment of mankind.

Educational Values of Course in Agriculture.

~~Saturday Conference, by A. C. True, Dean.~~

The educational values of courses in Agriculture are determined by the same pedagogic standards as are applied to courses in other subjects.

According to President Eliot of Harvard University, the essential constituents of education in the highest sense are as follows: "We must learn to see straight and clear; to compare and infer; to make an accurate record; to remember; to express our thoughts with precision; and to hold fast on lofty ideals." "There is also," he says, "general recognition of the principle that effective power in action is the true end of education rather than the storing up of information or the cultivation of faculties which

are mainly receptive, discriminating or critical."

According to Professor Hanus, Professor of Education in the same university, the subjects of instruction in a modern school course of study may be classified as follows: "(1) Language and literature; (2) social studies—history (including the history of industry and commerce as well as political history), government, descriptive economics; (3) art (including the history of art, as well as drawing, painting, modelling, music); (4) mathematics; (5) physical and biological science; (6) manual training."

The first two classes of subjects have a higher educational value theoretically, provided the student is interested in them, but if he has a greater interest in subjects of the other classes, they may have for him a higher educational value and may be advantageously used for the development of habits of efficiency. The individuality of the pupil is considered of more importance as the pupil advances in age and maturity. School courses, especially in high school and college, should, therefore, particularly promote the development of each pupil's dominant interests and powers and further should seek to render these interests and powers subservient to life's serious purposes, which include self support or some worthy form of service and intelligent active participation in human affairs.

In this view of the educational problem as related to modern civilization with its elaborate industrial system, we do well to unite culture and vocational studies in school and college courses.

In considering the courses of study for our agricultural colleges in the light of these pedagogic principles, we should always bear in mind that a properly constituted agricultural course, taken as a whole, will include both culture and vocational studies. This is well illustrated

by the course of study proposed for our agricultural colleges by standing committees of the Association of American Agricultural Colleges and Experiment Stations. This four-year college course includes English, Modern Languages, Psychology, Ethics, Political Economy, General History, Constitutional Law, Drawing, Algebra, Geometry, Trigonometry,—as culture studies; next there are the pure sciences: Physics, Chemistry, Botany, Zoology, Physiology, Geology, and Meteorology; lastly, the vocational studies: Agriculture, Horticulture and Forestry, Veterinary Science, and Agricultural Chemistry. As regards the time assigned to these subjects, we find that two-thirds of the entire course is occupied with culture and scientific studies, leaving one-third of the time for agricultural science and its applications to the art of Agriculture.

There is no need then to discuss the educational values of two-thirds of this course for these are already well established. It will perhaps help us to determine more accurately the educational values of the remaining third, i. e., the agricultural portion of the course, if we divide it into two sections. A large part of it consists of the study of the different branches of the science of Agriculture. Essentially, these have educational values as scientific studies, varying according to their nature and scope. In their entirety, they cover quite a wide range, since they include materials drawn from Physics, Chemistry, and various Biological sciences, Engineering, and Economics. Leaving out for the present the manual operations which we desire to consider separately as the second section of the agricultural division of the college course, agricultural science embraces all the other lines of instruction laid down by Professor Hanus, except Language and Literature; that is, it in-

cludes physical and biological science, mathematics, art, and social study. Properly taught, the student of agricultural science will "see straight and clear; compare and infer; make an accurate record; remember; express his thoughts with precision; and hold fast on lofty ideals."

From the complex nature of the agricultural sciences, they should have high educational values along these different lines.

The objects, facts and phenomena brought before the student of agricultural science are of such a kind as to test his capacity to "see straight and clear" in a very high degree. Whatever previous training he has had in this line will doubtless aid him in this new and higher field of science, but however good his previous training, he will find very much to train and develop his perceptive powers in observing the complex things involved in agricultural science. The soil, cultivated plants, domestic animals are not simple and elementary things, easy to be apprehended and comprehended. If we are to know them in any accurate sense, we must see straight and clear and long. These agricultural subjects also furnish innumerable opportunities for comparisons, most of which will be far from simple and the problems of correct inferences in this line of study are as difficult as they are multitudinous.

The classification of soils and the determination of their relative fertility and adaptation to different crops; the judging of live stock on the broad basis of their fitness for particular uses,—what opportunities in such studies "to compare and infer." Considered as "mental gymnastics" a class in stock judging may have as much exercise as a class puzzling over the mysteries of the Latin or Greek subjunctive mood; that is, if our agricultural students are *taught* and not *lectured*.

No one would dispute that the agricultural subjects give ample opportunity for exercise in "making an accurate record" of what is learned.

Memory certainly need not lack for exercise amid the innumerable multitude of items included in these agricultural subjects. It is undoubtedly a pity that memory training is too much neglected in our modern educational schemes, but this is not for lack of materials on which to work; it is often a lack of proper selection of things to be remembered or the misguided effort to remember too many unimportant items.

And if ever there were subjects in which it was desirable to express our thought with precision, it is these agricultural subjects. If only agricultural writers, teachers and students would learn to do that so that we might distinguish between their actual knowledge and their theories, it would be a great gain for the cause of truth and science. And the expression of the thought may come through language or mathematics or the graphic arts.

It also may be fairly claimed that the study of Agriculture in its human relations may have an ethical side of much educational value. We should teach men in our agricultural colleges to be intelligent farmers not simply that they may thus make a better living, but also that they may be leaders in making Agriculture a live, progressive art, which, in the future, shall provide a more stable and satisfactory basis for thrifty, intelligent, and refined rural communities, as well as a stronger guarantee for the manufactures, commerce, art, literature, and science of a higher civilization in which industrial and civil peace and not war shall be the established order.

But the relative educational value of agricultural courses will depend largely on the methods of teaching employed. Among the pedagogic principles, which

should underly good teaching of agricultural subjects are the following:

(1) The foundation of educational success in agricultural courses must be laid in the interest of the student. The teacher should, however, remember that this is not the only principle to be observed. There may be much interest without much instruction. The stump speaker often excites his hearers to the highest pitch of interest without giving them any useful information, and a teacher may keep pupils in an excited state of mind without their making any material progress in learning.

(2) There should be careful selection and systematic arrangement of topics to be taught in a given course so that the student will learn the most important things which he needs to know, and will be put in possession of a system of truth regarding Agriculture, which he can grasp and hold as a permanent mental possession.

(3) The methods of teaching agricultural subjects should be such as to afford the opportunity and impose the necessity on the student of exerting himself strenuously to gain the mastery of these subjects,—hence the advantage of the so-called laboratory methods as contrasted with lecturing.

(4) To give a high educational value to agricultural courses attention must be paid to the time element in education, meaning by this not so much the duration of agricultural courses as the relative amount of mental activity compressed into a given time through skillful teaching. Hence the necessity of much attention to the devising of laboratory methods of instruction which will permit rapid and varied work, the previous preparation of materials so that there may not be delays in the class room, and the holding of the student to strenuous effort from first to last.

(5) The educational value of courses in Agriculture will also depend on the extent to which they are made the means for developing originality and executive capacity in the students. It is not enough that through such courses the student shall gain much exact and useful knowledge or correct methods of activity. He should acquire ability to seek and find new truth and to guide and control the activities of other men in practical and scientific lines. The college graduate is not the man he ought to be unless he is capable of adding to the sum of human knowledge and becoming a leader in human progress. The quality of the future work of our experiment stations and departments of agriculture will depend on the original power developed in the graduates from our agricultural courses. The progress of the practical agriculture of this country in competition with the world will depend very largely on the quality of the leadership of the graduates from these agricultural courses. And the organization of the agricultural industries on right lines, as well as the betterment of the social condition of agricultural communities, will naturally depend very much on the work of the agricultural colleges and their graduates. The signs all point to the wider and stronger influence of educated men in the large affairs of industry and public business, including the narrower range of public business which we ordinarily call the government. In these broad lines, there will be abundant opportunities for agricultural graduates to make for themselves honorable and useful careers. Their success in this direction will depend largely on the quality of the teaching they receive in agricultural courses.

Dairy work in the Summer School.

Two periods in each day of the post graduate summer school of agriculture have been devoted to dairy work. The first period, from eight to ten in the morning, has been in the form of a lecture, and the period in the afternoon has been practical work in the laboratory or judging room. The first week Dr. Corn discussed fermentations in milk, butter and cheese. He brought out some new and interesting facts. Prof. Wing took up the subject of milk from a commercial standpoint, discussing in the lecture room sanitary, standardized, pasteurized and modified milk, and illustrated the work at the dairy barn and in the laboratory.

The second week Prof. C. D. Smith occupied the morning period in a discussion of feeding problems. His work took a very practical turn and his suggestions about teaching were to the point. Dr. Scovell occupied the first three afternoons of the week on the subject of judging dairy cattle. His first period was in the form of a stereoptican lecture and free parliament about the subjects shown on the screen, and all present voted the two hours a decided success. The following two afternoons were devoted to judging of animals in the stock judging room.

Prof. T. L. Haecker followed Dr. Scovell by two periods. The first period was spent in the lecture room, where Prof. Haecker showed pictures of animals that he has been working with the past ten years and gave the records of their performance during that time. The second period was spent in the stock judging room with animals brought in for the occasion.

The third week brought to us in the morning hour Dr. Van Slyke, who discussed his subject of the chemistry of

cheese making in the manner of an ideal teacher. He used the blackboard freely, writing down upon it the outline of the discussion for the day, and illustrated his

work petitioned him to put it into printed form at as early a date as possible.

The afternoon period was filled by Prof. McKay, of Iowa, by practical but-



T. F. HUNT,

Dean of the College of Agriculture, and Professor of Agriculture,
Ohio State University.

work with numerous tables of analyses of milk and cheese. Figures may be very uninteresting, but Dr. Van Slyke wove them together in a very attractive manner. The class at the close of his

ter making. A good supply of milk and cream was supplied and Prof. McKay illustrated methods of making starters, how to use them and how to produce high-flavored butter. He also illustrated

Danish methods. Butter was secured from a Columbus wholesale butter house and a demonstration in scoring butter was given.

Several students came to the school with the desire of getting as much as possible out of the cheese work. Accordingly laboratory work in cheese making was begun at the same time and has been carried on parallel with the butter work. Cheddar and brick cheese have been made each afternoon. It will be carried on the last week of the term as scheduled, and will include work with the Wisconsin curd test and demonstrations in judging cheese.

As this copy goes into the hands of the type "setter" before the last week begins we cannot report Dr. Allen's lectures, but express the belief that he will be as successful in his subject as his predecessors have been in theirs.

The instructional work is proving successful beyond the hopes of the promoters of the school, but the association of the dairy instructors of ten or more states is proving the most pleasant and helpful feature of all.

Anderson, from California; Haecker, from Minnesota; McKay, from Iowa; Moore, from Missouri; Erf, from Illinois; Van Norman, from Indiana; Michels, from Michigan; Decker and Crouner, from Ohio; Hayward, from Pennsylvania; Wing and his force, Ford, McLallen and Griffith, from New York; Gowell, from Maine; Kendall, from North Carolina; Upton, from South Carolina, and Johnson, from George, have really become acquainted with each other and have an interest in each others work. They have met together a number of times at the home of Professor Decker and each has told of his peculiar fields of labor, while the others have listened with intense interest.

The University of California dairy yell was made over to fit the circumstances and runs as follows:

Whole milk, skim milk, butter milk,
Cream,
With bacteriological phenomena teem,
Bacillus Cacticus dropped in and grew,
Post Grad, Dairy Boys, Nineteen-two.

This issue would not be complete without some reference to the man in whose mind originated the idea of the Graduate Summer School in Agriculture. Every student of the Graduate School is now personally acquainted with Professor Hunt, and knows something of his successful career in the ranks of the leading agricultural educators of this country. It is not necessary for us to give in detail the past history of Professor Hunt's life. Suffice it to say that after a successful period of service in Illinois and Pennsylvania State Colleges he came to Ohio State University in 1891. Since that time one of the finest agricultural buildings in the world has been erected on the campus, which is fully equipped to give thorough instruction in modern scientific agriculture. The number of students in agriculture has also increased from a mere handful to nearly two hundred. There is perhaps no other man who enjoys the confidence and respect of his co-workers in advanced agricultural work to a greater extent than Professor Hunt.

McLaughlin Brothers, importers of French coach and draft horses, whose advertisement appears on the opposite page, have just unloaded their recent shipment of some one hundred and twenty as fine horses as money and expert judgment could find in Europe. Quite a number of the Graduate School students visited their stables last week.

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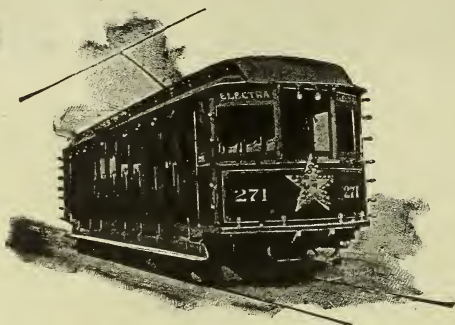
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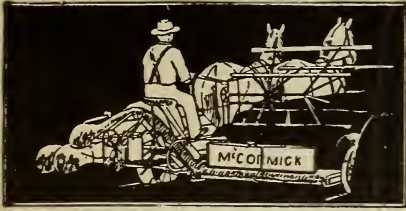
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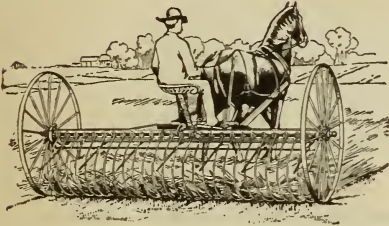
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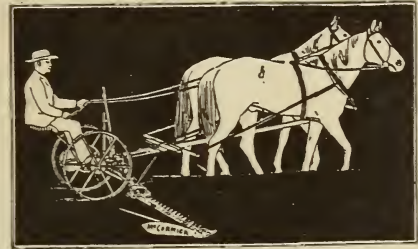
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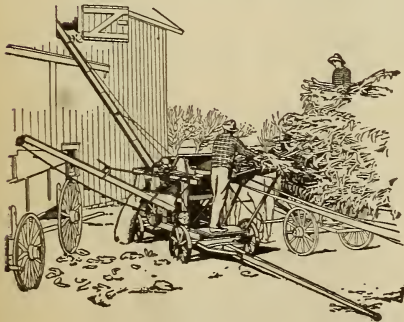
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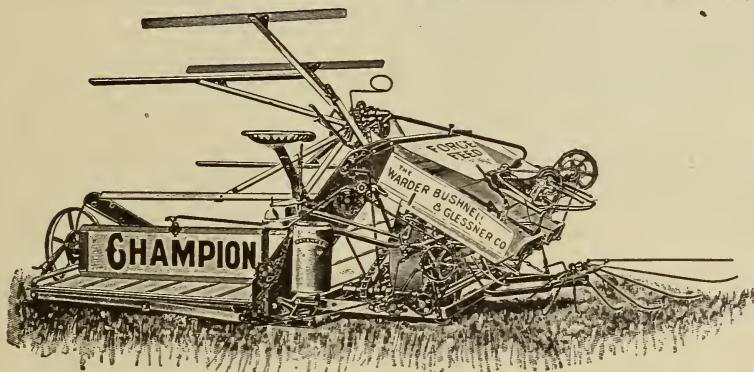
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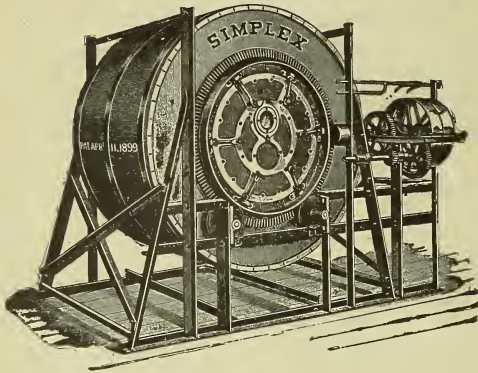
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